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FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES

FIT PROJECT

TDD # F1-8005-01F

December 5, 1980

TASK REPORT TO THE ENVIRONMENTAL PROTECTION AGENCY CONTRACT NO. 68-01-6056

SDMS DocID 282303

SITE INSPECTION REPORT
of
OLIN CHEMICALS GROUP PLANT

Eames Street
Wilmington, Massachusetts

Submitted to:
John Hackler, Chief
Office of Uncontrolled Waste Sites
U.S. EPA, Region I

Submitted by:
David Cook, Project Leader
Ecology and Environment, Inc. (E & E)
FIT Team, Region I

ecology and environment, inc.

International Specialists in the Environmental Sciences

SITE INSPECTION REPORT

FOR

OLIN CHEMICAL GROUP
WILMINGTON PLANT

TDD #:	F1-8005-01F
Firm Name:	Olin Chemicals Group
Address:	Eames Street Wilmington, Massachusetts
Telephone:	203-356-3156
Owner:	Corporation
Principal Contact at Site:	Mr. David Vaughn (Hartford Office)

1. <u>Purpose of Inspection:</u>

To gather information and samples necessary to determine the potential for possible RCRA and/or 311/104 Clean Water Act actions against Olin Chemical Group.

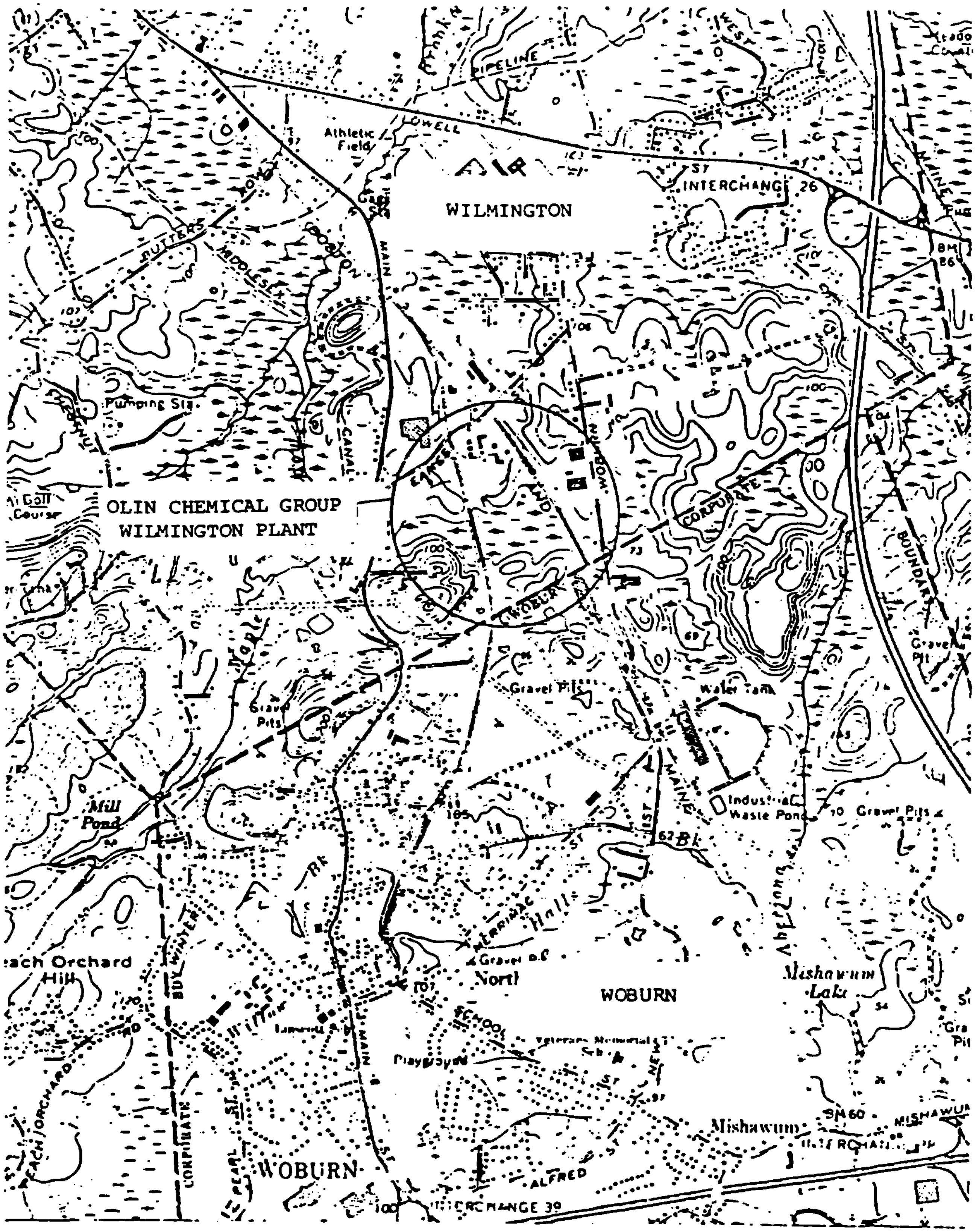
2. <u>Objective:</u>

To conduct an on-site investigation of the Wilmington Plant site in order to locate evidence of contamination, identify possible contaminants and collect appropriate samples for screening and analysis.

3. <u>Background:</u>

3.1 Description:

The Olin Chemicals Group Wilmington Plant occupies a 53-acre site south of Eames Street in Wilmington, Massachusetts. The site is bounded on the east by the Boston and Maine railroad tracks, on the south by the Woburn-Wilmington town line, on the west by a Boston and Maine railroad spur, and on the north by Eames Street (See Figures 1 and 2). The property was purchased by Olin Chemicals Group in September, 1980 from the Stepan Chemical Company which had occupied the site since 1971. Chemical plant operations on this site began in 1953 under the ownership of National Polychemicals, Inc. which merged with Stepan Chemical Company in 1971. The northern one-half of the site is occupied by the production facilities, and the southern one-half is wooded. A drainage ditch parallel to the Boston and Maine tracks borders the eastern project site boundary and carries water from north to south. This drainage ditch continues adjacent to the tracks until its confluence with Hall's Brook about 0.9 miles south of the site. Nearly all surface water on the site is routed to a single channel which [illegible]s into the drainage ditch, as shown in Figure 2.



From USGS Quadrangle Map - Wilmington Quadrangle.

Scale: 1" = 2000'

Figure 1 - Location Map of
Olin Chemicals Group
Wilmington Plant.

3. Background:

3.1 Description -continued

At the time when the aerial photograph presented in Figure 3 was taken (April 24, 1971), three acid pits existed to the south of the processing facilities. These pits have been replaced by rectangular settling basins as shown in Figure 4 (photographed on April 29, 1977). An extensive area of distressed vegetation is present in the east-central portion of the property. Also on the property are eleven large storage tanks noted in Figure 4. there are twelve wells on the property as noted in Figure 2.

3.2 Primary Site Activity:

Several chemicals have been synthesized on-site from a variety of ingredients. The processes used and the final products are as follows (quantities based on 1973 production figures):

Opex Process -	Dinitropentamethylenetetramine (DNPT), a slightly water soluble solid used as a blowing agent in the production of expanded rubber compounds, 1.2 million pounds per year.
Kempore Process -	Azodicarbonamide (Kempore), also a slightly water soluble solid used as a rubber blowing agent, 1.6 to 1.8 million pounds per year.
Wytox Process -	Wytox, a liquid phosphite rubber stabilizer, one million pounds per year.
Wytox ADP-X Process -	Dioctyldiphenylamine (DODPA), a dark colored resinous solid, 600,000 pounds per year.
O.B.S.H. Process -	Oxybisbenzenesulfonylhydrazide (OBSH), a rubber blowing agent, 300,000 pounds per year.

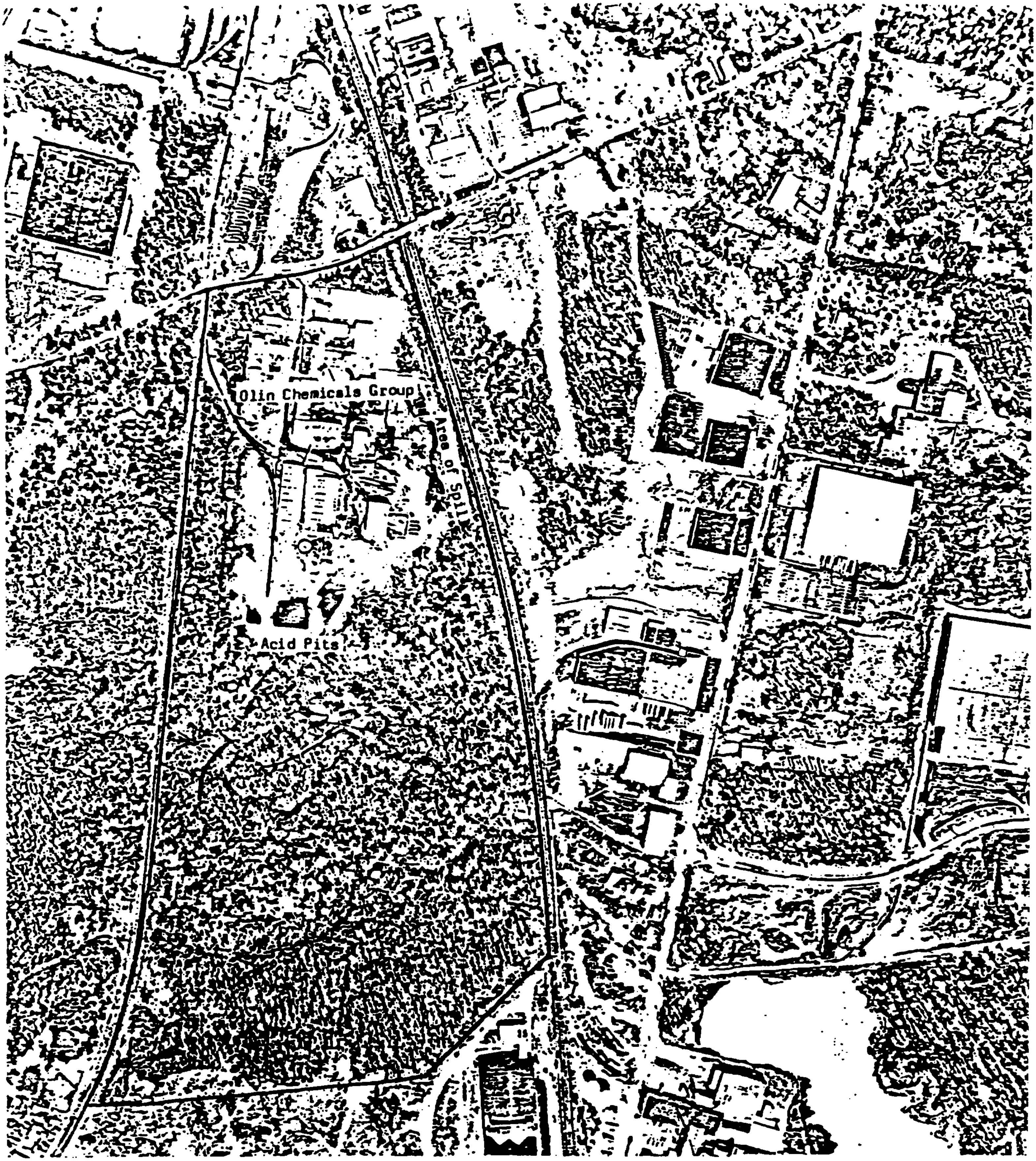


Figure 3 - April 24, 1971
Aerial Photograph Showing the Location of the Former Acid Pits.

3. Background:

3.2 Primary Site Activity - continued

Raw materials and waste products for the preceding processes are listed in Table 1. Only those waste products discharged into the yard or floor drainage system are listed. The drainage system is shown in Figure 5.

In addition to the above processes, numerous coatings for rubber products were produced on site. The following chemicals were used to produce the coatings:

Bentone
Santocel
Ufamite MM 67
Toluene
Butylacetate
Acrylic Resins
Maleic Anhydride
Glycerine
Fatty Amines
Silicone
Monoethanolamine
Mineral Oil

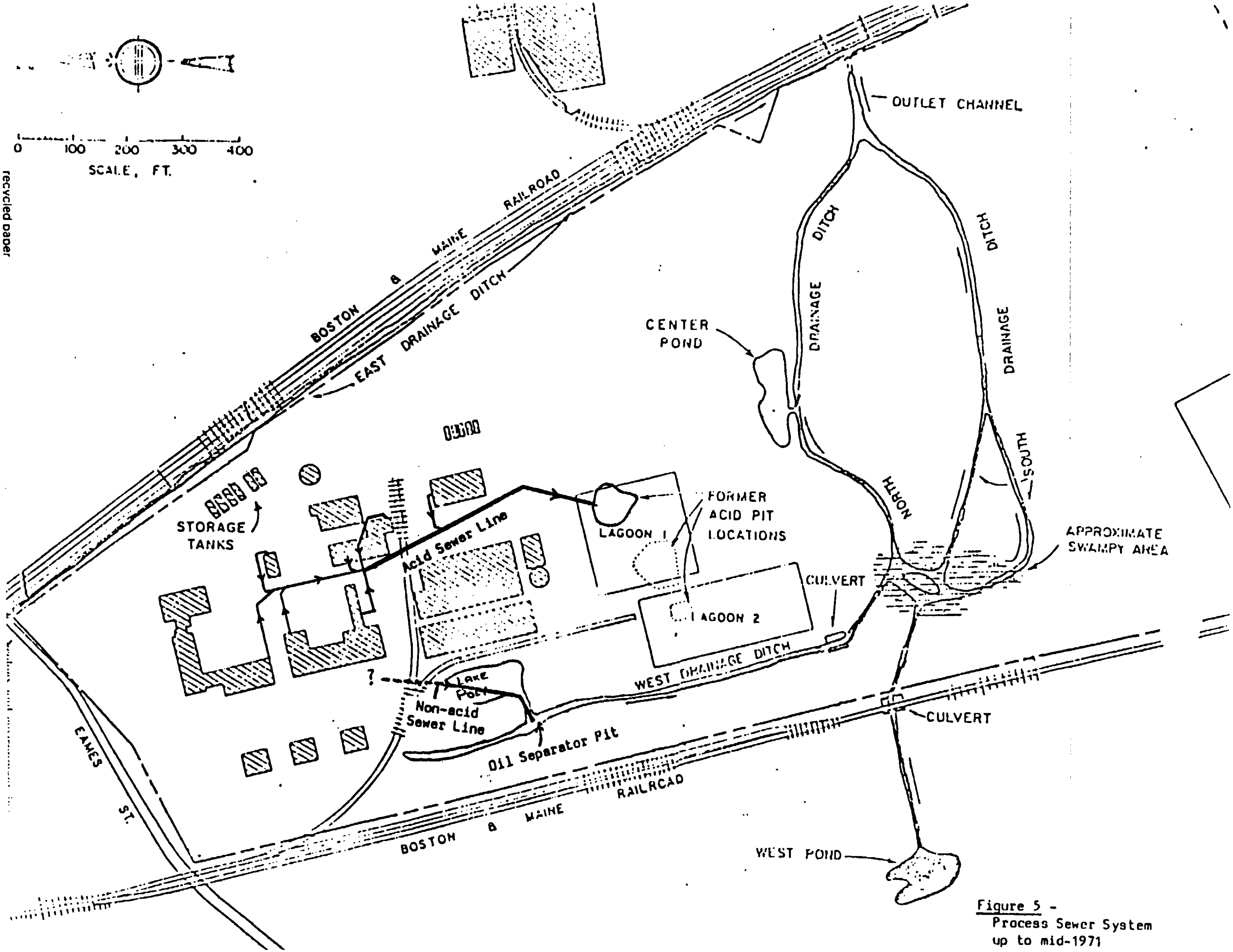


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Figure 5 -
Process Sewer System
up to mid-1971

3. Background:

3.2 Primary Site Activity - continued

TABLE 1 - Raw Materials and Waste Products Associated With Chemical Processes Used by National Polychemicals, Inc. and Stepan Chemical Company between 1953 and 1978.

Process	Raw Materials	Waste Products
Opex	anhydrous ammonia formaldehyde sodium nitrite hydrochloric acid	sodium chloride formaldehyde sodium nitrite process oil
Kempore	liquid chlorine urea sodium hydroxide sulfuric acid hydrazine	sodium sulfate sodium chloride ammonium sulfate urea sulfuric acid
Wytox	phosphorous trichloride paraformaldehyde nonyl phenol	None sewered
Wytox ADP-X	diphenylamine diisobutylene aluminum chloride	diisobutylene aluminum hydroxide sodium chloride
O.B.S.H.	diphenyloxide chlorosulfonic acid	sulfuric acid

3. Background:

3.2 Primary Site Activity - continued

According to MDC records, the following materials were being stored on-site as of June 30, 1980:

MATERIAL BEING STORED:	Annual Thruput (gals.)	Type of Storage Container (tank, drum, etc.)	Size of Container (gals.)
1. Formaldehyde	172,500	Tank	13,300
2. Nonyl phenol	281,600	Tank	10,000
3. Dinonyl phenol	30,500	Tank	6,700
4. Ethyl hexoic acid	18,400	Tank	5,000
5. Dioctylphthlate	54,200	Tank	15,000
6. Process Oil	11,800	Tank	4,250
7. TNPP (Wytox 312)	50,000	Tank	10,000

Chemicals used or manufactured at this site are transported in 55-gallon drums by railcar.

3.3 Secondary site activity:

N applicable

3. Background:

3.4 Hazards Identified or Alleged:

Potential sources of contamination as a result of on-site activities past or present are the following:

1. Leaking of materials from storage tanks.

2. Leaching of materials from acid pits.

3. Leaching of materials from burial sites.

4. Exfiltration from sewers.

A close examination of the chemicals which have been used on-site indicates that only a small number may have contributed or are contributing to an environmental hazard. Toluene and dioctylphthalate are included in the Federal Register list of priority pollutants. It is highly likely that toluene would have volatilized soon after a spill. Dioctylphthalate is very persistent and has been associated with pneumonia-like symptoms. Several other chemicals used on site including hydrazine, nonylphenol, dinonylphenol, and ethyl hexoic acid may cause undesirable symptoms. The extensive vegetative stress noted on-site is probably the result of high sodium chloride and sulfuric acid concentrations leaching from the former acid pits.

Prior to 1971, all waste materials were disposed of on-site either into a series of three acid pits or directly into a series of channels on the property. Eventually, all material either leached or drained into the ditch paralleling the Boston and Maine railroad tracks and proceeded ultimately to the Aberjona River. In 1971, disposal of wastes was changed to the system presently in use. Sulfate bearing wastes are mixed with a calcium hydroxide slurry to form a calcium sulfate sludge which is disposed of in two polyvinyl chloride (PVC)-lined lagoons. An analysis of this sludge is as follows (anal.ed by National Polychemicals, Inc., September 1970):

3. Background:

3.4 Hazards Identified or Alleged - continued

Water	27,500 lbs.
Gypsum	26,800 lbs.
$CaCO_3$	650 lbs.
Calcium Oxbisbenzene Sulfonate	Trace
Na_2SO_4	Trace
$Al(OH)_3$	Trace
NaCl	Trace
$CaCl_2$	Trace
Formaldehyde	Trace
$NaNO_2$	Trace
NH_4Cl	Trace
TOTAL	54,950 lbs. = 27.5 Tons/Day

A study performed in 1979 by Geotechnical Engineers, Inc. of Winchester, Massachusetts, indicated that several holes exist in the PVC liner (See Figures 6 to 8). It was also discovered that sludge has been dumped in an emergency lagoon when the two existing lagoons filled to capacity (See Figure 4). This emergency lagoon had no liner and was formed by dredging soil to form a roughly rectangular area. Solids from the lagoons are dredged periodically and landfilled on the southwest corner of the property. The landfill site was approved by the State Department of Environmental Quality Engineering (DEQE). The analysis of the sludge indicates that no environmental hazards would result from leaching of the lagooned or landfilled materials into the ground.

Non-sulfate bearing wastes generated on-site are presently discharged into an underground sewer line which connects to a Town of Wilmington owned sewer This line connects to a Metropolitan District Commission (MDC) sewer ne. Complaints regarding high chloride, sulfate and ammonia le s in the sewer effluent have been made on

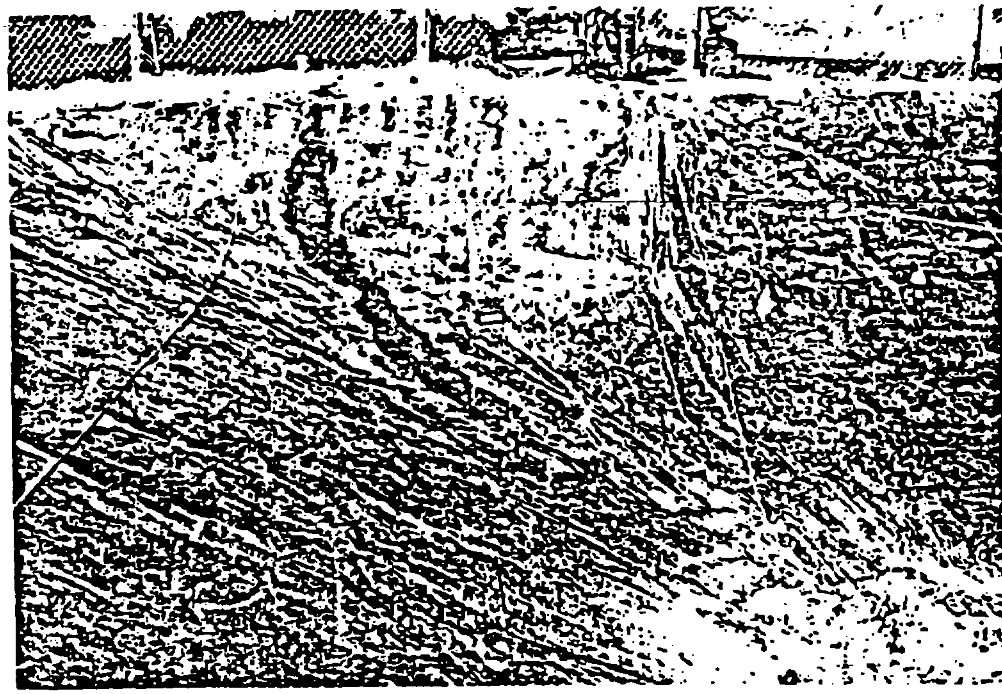


Figure 6 - Leak Along the Seam of the Polyvinyl Chloride Liner in the Sulfate Sludge Lagoon.

Figure 7 - Enlargement from Figure 6.

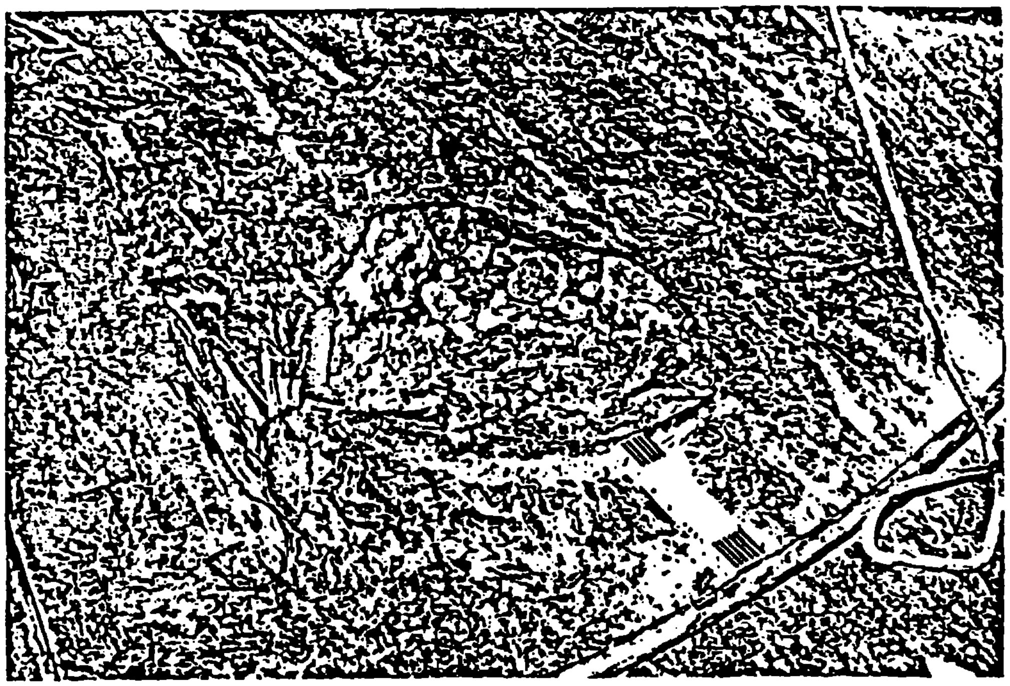


Figure 8 - Hole in the Polyvinyl Chloride Liner Associated with the Sulfate Sludge Lagoon.

Figure 9 - Sheen resulting from "black ooze" seeping into the Drainage Ditch.

3. Background:

3.4 Hazards Identified or Alleged - continued

An unofficial report from a former Stepan employee indicates that phosphorus trichloride was often dumped directly into the ground and that residues were buried next to the wetlands near the drainage channel. Sediment and ground water samples were taken in an attempt to confirm or deny the existence of an environmental hazard resulting from such alleged activities.

A 1977 aerial photograph shows two areas where drums were stored on-site (See Figure 4). Leaks in these drums may have resulted in ground water contamination. The 1971 photo (Figure 3) also reveals a spill generating from the group of six large storage tanks on the east side of the property. Since 1973, "black ooze" has been noted seeping into the drainage ditch paralleling the railroad tracks east of the site (Figure 9). A sample was taken by the E & E, FIT team on October 2, 1980, (See memo to John Hackler from David Cook dated October 6, 1980). A conversation between D. Cook (E & E) and D. Vaughn (Olin) revealed that dioctylphthalate, dimethylamine, dioctylamine and other related compounds are present in the "black ooze" as well as in Well GW-2 (See Figure 2). This was determined by an analysis performed by Olin. Mr. Vaughn was very hesitant to have Well GW-2 sampled. He stated that he knew the well was contaminated and Olin was prepared to perform remedial actions of an undisclosed nature to rectify the situation.

The drainage ditch mentioned above has been the object of sampling and analysis on several occasions. On January 23, 1980, five samples were collected by the EPA and subsequently analyzed for purgeable organics. The results indicated the following:

1. Moderate to high levels of 1,1 - dichloroethane, 1,1,1 - trichloroethane, trichloroethylene, toluene and xylene are present upstream of Stepan/Olin.

3. Background:

3.4 Hazards Identified or Alleged - continued

2. Moderate to high levels of 1,1,2 - dichloroethylene and 1,1,2 - trichloroethane in addition to the five chemicals listed under (1) are present downstream of Stepan/Olin.

3. Therefore, some chlorinated hydrocarbons may be leaching from Stepan/Olin into the drainage ditch.

4. Analyses of the outfalls from Stepan/Olin do not indicate significant off-site migration of contamination.

Priority pollutant samples were taken from the drainage ditch paralleling the railroad tracks on July 28, 1980. Analyses of samples taken upstream and downstream of the Stepan/Olin property suggested that small amounts of the priority pollutants listed in Table 2 are generating from the site.

The primary purpose of this site inspection was to gather appropriate samples for analysis to determine if any ground or surface water contamination is generating from Olin property. The sampling plan is presented in Section 4, and the sampling procedures and screening results are included in Section 7.2 of this report. The preliminary results indicate that, with the exception of the "black ooze" and significant amounts of residual heavy hydrocarbons noted in Section 7.2, no significant sources of contamination are present on site. Evidence of buried drums was noted just west of the headwall (See Figure 2). However soil, surface water and groundwater revealed no evidence of hazardous chemicals generating from the burial site.

4. Concept of Operation:

A seven-person team entered this site to identify the nature of materials stored on site, investigate possible sources of contamination and collect appropriate samples for screening and analysis.

Table 2:

Priority Pollutants Suggested To Be Entering the East Drainage Ditch from Olin Property
(Based on July 28, 1980 Priority Pollutant analyses)

CONTAMINANT	METHOD OF CONTACT	HEALTH EFFECTS
Trichloroethylene	Inhalation:	Headache, nausea, drowsiness
	Chronic Inhalation:	Possibly liver damage. (This has not been documented in Humans).
	Inhalation of large quantities:	May cause narcosis
	Ingestion:	Possibly liver damage. (This has not been documented in humans).

Note: TCE is an experimental animal carcinogen. (rats). 1979 recommended ambient water quality criterion 2ug/l Based on tumors in rats and not on human health affects.

N-Nitrosodiphenylamine	Ingestion only	Not an inhalation hazard.
	Toxicity:	This compound belongs to the class of nitrosamines.

Note: Nitrosamines are suspected human carcinogens. There are no human data, but nitrosamines do cause tumors of the stomach, lung, liver, bladder and kidney in rats. The class criterion is 0.1/ug/l water (ambient water) based on tumor formation in rats.

Bis (2-Ethyl hexyl) phthalate

Note: Phthalates are non-biodegradable and potential aquatic hazards. They have no documented human health effects that may be associated with environmental hazards.

Phthalates are used as plasticizers in latex materials and are often used in medical equipment such as IV infusion sets.

Phthalates may leach off of such equipment and are suspected in the etiology of shock lung syndrome when injected intraveneously.

1,1,2 - Trichloroethane	Toxicity - Inhalation:	Narcotic, local irritant may (B - cause liver and kidney damage.
	Ingestion:	Local irritant (in 1 ug/l concentrations) suspected to cause liver and kidney damage

Note: It may be a percutaneous hazard - when hands are immersed in concentrated liquid (only).

1,2 - trans-Dichloroethylene	Toxicity:	low toxicity except when exposed to concentrated vapor - nausea, vomiting, dizziness with immediate recovery upon removal from exposure.
	Ingestion:	Ingestion of concentrated liquid - hausea, vomiting.

Note: 1,2 - DCE is a dermatitis producing agent. It is not percutaneous.

Vinyl Chloride:

Note: A well-known human carcinogen. 1979 ambient WQ criterian = 51 ug /l based on tumor-production in rats

4. Concept of Operation - continued

The following instruments were used during the visit to delineate potentially hazardous areas and screen samples:

1. Century organic vapor analyzer (OVA)

2. Explosimeter

3. Oxygen meter

The site sampling plan was based upon existing knowledge of groundwater and surface water movement on Olin property. The groundwater contours presented on the overlay for Figure 10 are from a report entitled "Report on Groundwater and Surface Water Study - Stepan Chemical Company, Wilmington, Massachusetts" by Geotechnical Engineers, Inc. of Winchester, Massachusetts (1979). Both groundwater and surface water moves in a northwest to southeast direction. As a result, priority pollutant groundwater and surface water samples were taken near the southeast corner of the site. A priority pollutant groundwater sample was taken near the northwest corner of the site for background data. A total of eight groundwater, ten surface water and five soil samples were taken. The sampling locations are shown in Figure 10. See Section 7.2 of this report for detailed sampling procedures and preliminary screening results. Parameters for the monitoring wells on Olin property are presented in Table 2.

All samples were iced immediately and brought to the EPA Regional Laboratory in Lexington, Massachusetts, for further screening and analysis. Appropriate decontamination measures were followed prior to leaving the site. The safety plan and report are included in Appendix A.

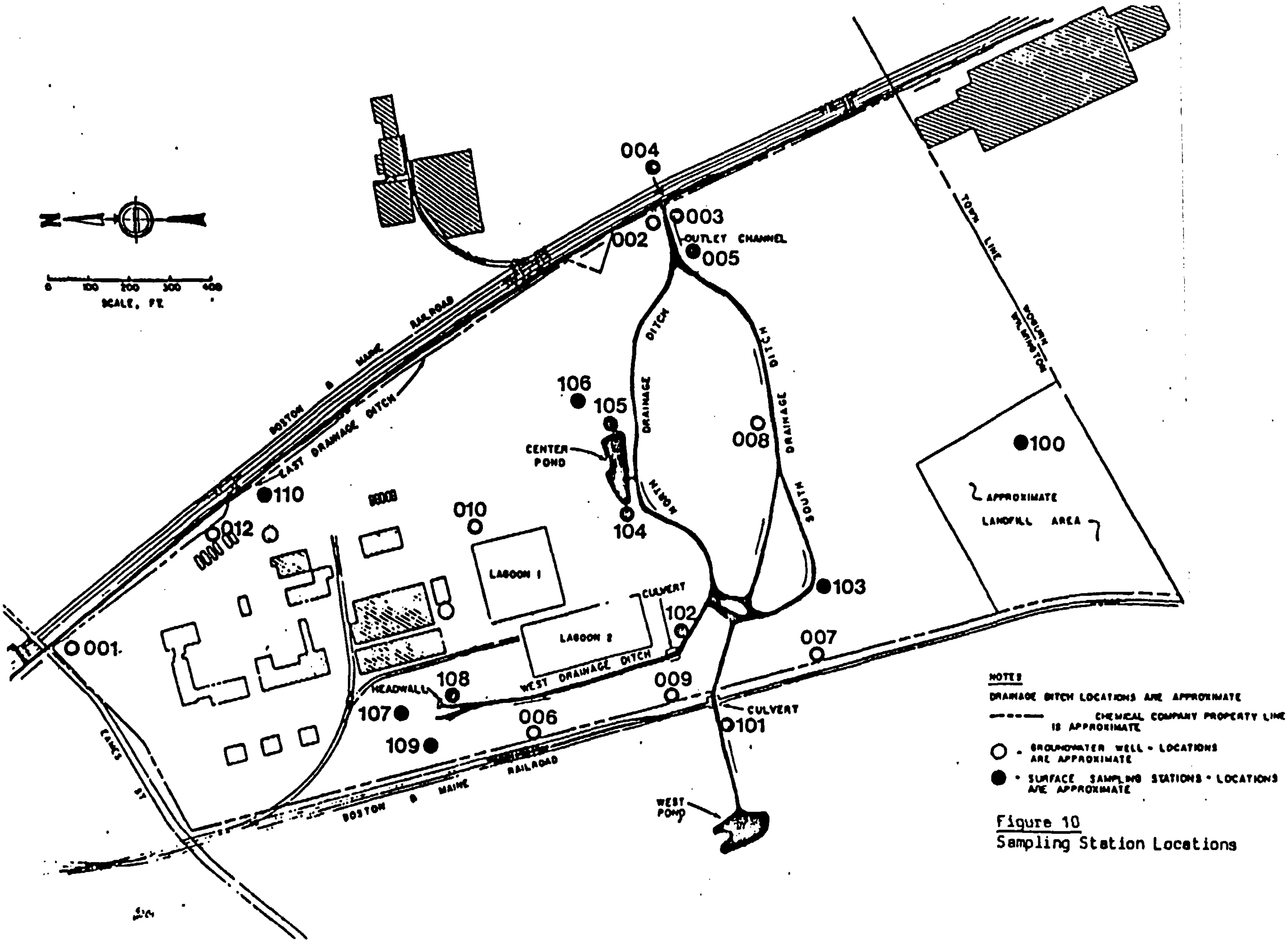


Figure 10
Sampling Station Locations

TABLE 3 - Parameters for Monitoring Wells on the Olin Property in Wilmington, Massachusetts

Well #	Depth of Well (ft.)	Water Table Depth (ft.)	Depth of Screened Section (ft.)
GW - 1	21.2	9.0	14.0 - 19.5
GW - 2	15.0	7.5	9.5 - 14.5
GW - 3	22.0	4.2	10.0 - 15.0
GW - 4	13.5	2.5	8.0 - 13.0
GW - 5	12.0	0	5.0 - 10.0
GW - 6	18.0	4.0	8.2 - 13.2
GW - 7	14.0	2.6	8.5 - 13.5
GW - 8	10.2	1.5	3.2 - 8.2
GW -10	24.0	5.4	4.8 - 9.8
GW -11	17.0	3.9	9.0 - 14.0
GW -12	12.7	0	4.8 - 9.8

- All wells have inside diameters of 1.5".
- Location of wells is shown in Figure 2 of this report.
- All well parameters are from: Report on Groundwater and Surface Water Study - Stepan Chemical Company, Wilmington, Massachusetts: Geotechnical Engineers, Inc. Winchester, Massachusetts, December 6, 1978.

5. Logistics and Site Setup:

Because of the large area covered during this inspection and the large amount of sampling equipment required to accomplish the objective, it was necessary to move the van and associated decon several times. Figure 11 shows the various locations of the van during the inspection. Equipment decontamination was performed after each sampling effort, and appropriate equipment and personnel decontamination measures were performed following the final sampling at Well GW-2 (Station 012).

No hot line was delineated as no "hot spots" were indicated during the preliminary assessment or the site inspection.

No logistical problems were encountered during the planning and performance of this site inspection. A minor pumping problem was encountered during sampling at the first groundwater station (001). However, following appropriate adjustments, samples were successfully retrieved from depths up to ten feet with the portable hand pump. The portability of this sampling technique was very important at Station 008 which was nearly inaccessible due to dense vegetation and swampy ground.

6. Site entry team and Schedule of Events:

6.1 Site Entry Team and Team Assignments:

David Cook	-	Site Entry Team Leader
Paul Clay	-	Sampling Officer
Lori Fucarile	-	Safety Officer
Glenn Smart	-	Equipment/Work Party
Richard DiNitto	-	Work Party
Margret Hanley	-	Work Party
Bill Norman	-	Work Party

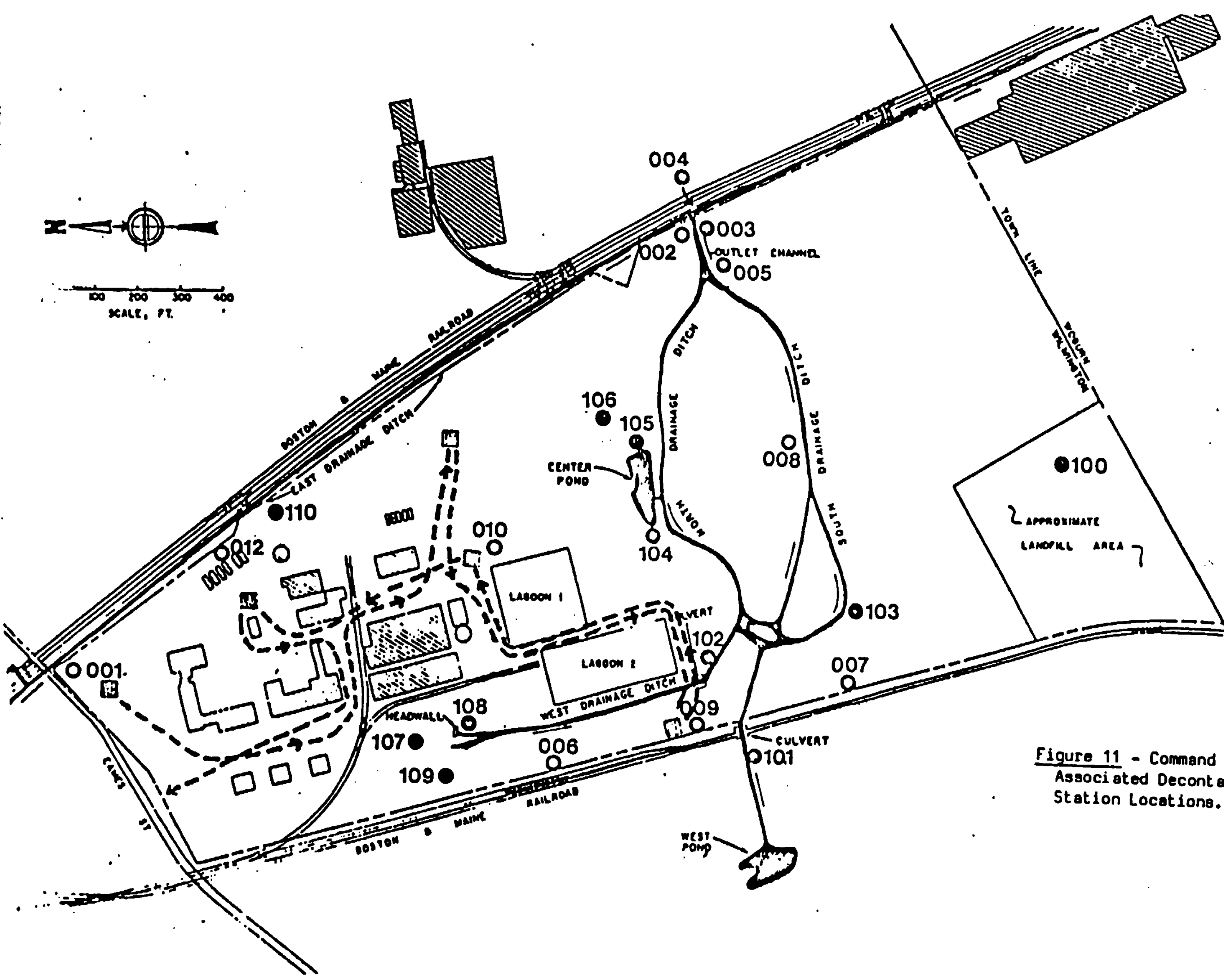


Figure 11 - Command Post and Associated Decontamination Station Locations.

6. Site Entry Team and Schedule of Events - continued

6.2 Schedule of Events

The site entry team was briefed by the team leader on November 11, 1980 (the day before site entry). The briefing included review of appropriate data obtained during the preliminary assessment for the purpose of making the team aware of all potential hazards. The briefing focused the team's attention on the questions raised by the preliminary site assessment.

In order to facilitate completion of sampling on November 12, 1980, the team was divided into two groups: Cook, DiNitto and Hanley (Team 1) collected the surface water and sediment samples and Fucarile, Clay, Smart and Norman (Team 2) collected the groundwater samples.

The following was the schedule of events for the site inspection.

0900 - Van arrives at Olin, team sets up decon and prepares sampling equipment. D. Cook meets with Olin representatives (Ted Groom and M. Ahsah of Olin Research Laboratory, David Vaughn, Environmental Coordinator and Ron McBrien, Plant Manager) and explains the objectives of the inspection. Split samples and duplicate photos are requested by McBrien and Vaughn.

0930 - Smart and Clay sample Well GW-1 (Station 001, Sample #70818).

1038 - Smart and Clay collect priority pollutant sample at Well GW-5 (Station 002, Sample #70809).

1040 - Cook collects priority pollutant sample of surface water at outlet of on-site drainage ditch (Station 003, Sample #70803).

6. Site Entry Team and Schedule of Events

6.2 Schedule of Events - continued

1100 - Clay samples culvert from E. C. Whitney (Station 004, Sample #70814).

1105 - Clay samples surface water from North Drainage Ditch (Station 005, Sample #70815).

1140 - Smart and Clay collect priority pollutant sample from Well GW-10 (Station 006, Sample #70816).

1200 - Team breaks for lunch and discusses sampling completed and still to be completed.

1315 - Team returns to site and divides into two groups described earlier (Teams 1 & 2).

Team 2:

1330 - Smart and Norman sample Well GW-12 (Station 007, Sample #70825).

1400 - Smart, Clay and Norman sample Well GW-8 (Station 008, Sample #70826).

1430 - Smart, Clay and Norman sample Well GW-11 (Station 009, Sample #70827).

1505 - Norman and Smart sample Well GW-6 (Station 010, Sample #70828).

1530 - Clay, Smart and Norman attempt to sample Well GW-7 (Station 011) but are foiled by a wasps' nest in the well.

1545 - Team 2 samples Well GW ? `tation 012, Sample #70812).

6. Site Entry Team and Schedule of Events

6.2 Schedule of Events - continued

Team 1:

1330 - Sediment sample taken with auger at sulfate sludge landfill (Station 100, Sample #70824).

1345 - Sediment and surface water samples taken on Jewel Industrial Park property just west of culvert leading to Olin property (Station 101, Sample #70817).

1355 - Sediment and surface water samples taken at culvert just south of the Lagoon 2 (Station 102, Sample #70807).

1420 - Surface water sample taken approximately 75 feet east of Well GW-12 (Station 103, Sample #70821).

1440 - Surface water sample taken at west end of Central Pond (Station 104, Sample #70822).

1500 - Surface water sample taken at east end of Central Pond (Station 105, Sample #70823).

1515 - Sediment and surface water samples taken in area of dead trees (Station 106, Sample #99999).

1530 - Soil sample taken where Lake Poly was formerly located (Station 107, Sample #70808).

1540 - Surface water taken near headwell (Station 108, Sample #70810).

1550 - Evidence of buried drums (rusted bands lids and two partially buried drums) noted just west of headwall. Shallow soil sample collected (Station 109, Sample #9998).

1610 - Soil sample taken from area just south of tank farm (Station 110, Sample #99997).

6. Site Entry Team and Schedule of Events

6.2 Schedule of Events - continued

Team 1:

1615 - Teams 1 and 2 reunite at van and proceed to decon personnel and equipment. Chain of custody forms are completed and D. Vaughn of Olin signs for split samples transferred to him.

1640 - Site Inspection completed, team returns to office.

7. Results of Investigation

7.1 Site Representative Interview:

A detailed interview regarding the processes used on site was not necessary as this information was gathered during the preliminary assessment and is incorporated into Section 3.2 of this report. Mr. David Vaughn, Environmental Coordinator for Olin Chemicals Group, did confirm the presence of dioctylphthalate, diphenolamine, dioctylamine and other related chemicals in the "black ooze" seeping into the East Drainage Ditch. The seepage appears to be the result of a spill generating from the tank farm which took place during or prior to 1973. Presented in Appendix C is a letter from Charles P. Riley, Jr., General Manager of National Polychemicals to Thomas C. McMahon, Director of Massachusetts Water Resources Commission, dated July 18, 1973, describing the presence of "black ooze". Mr. Vaughn also confirmed the presence of contamination in Well GW-2 related to this spill and was hesitant to have us sample this well prior to undisclosed remedial action planned by Olin.

Mr. Vaughn expressed his desire to obtain duplicate samples and photographs associated with the site inspection.

7. Results of Investigation - continued

7.2 Sampling procedures and screening results:

7.2.1 Groundwater sampling procedures

The preparation for sampling the monitoring wells on the Olin property was the same in each case: (Note: All wells were capped and bolted. The bolts were sawed off to remove the well cap.)

First, the static level of water in the well was determined with a water level indicator. Second, the bottom of the well was sounded. using these two measurements and the diameter of the well casing (1 1/2", in each case), the static volume of water in the well was calculated. Third, a hand operated vacuum pump attached to a sufficient length of Tygon tubing was used to discharge five times the static volume of the well. (This amount of discharge was not possible in some wells because of slow recharge and silted-in screens.) Following discharge, a volume of sample appropriate for the desired analytical parameters was collected by pumping. E & E personnel first filled their bottles and then filled bottles for Olin sampling personnel.

Between the sampling of each well, the sampling line and pump was cleaned by rinsing thoroughly, first with methanol and then with distilled water. The E & E sampling crew consisted of Paul Clay and Glenn Smart for wells GW-1, 5, and 10 and Paul Clay, Glenn Smart and William Norman for wells GW-12 8, 11, 6, 7, and 2. A groundwater elevation contour map prepared from data gathered during sampling is presented in Figure 12, which is very similar to Figure 10, the groundwater elevation contour map prepared by Geotechnical Engineers. The major difference is that surface of the the water table was generally 1 1/2 to 2 feet lower at the time of the E & E site inspection.

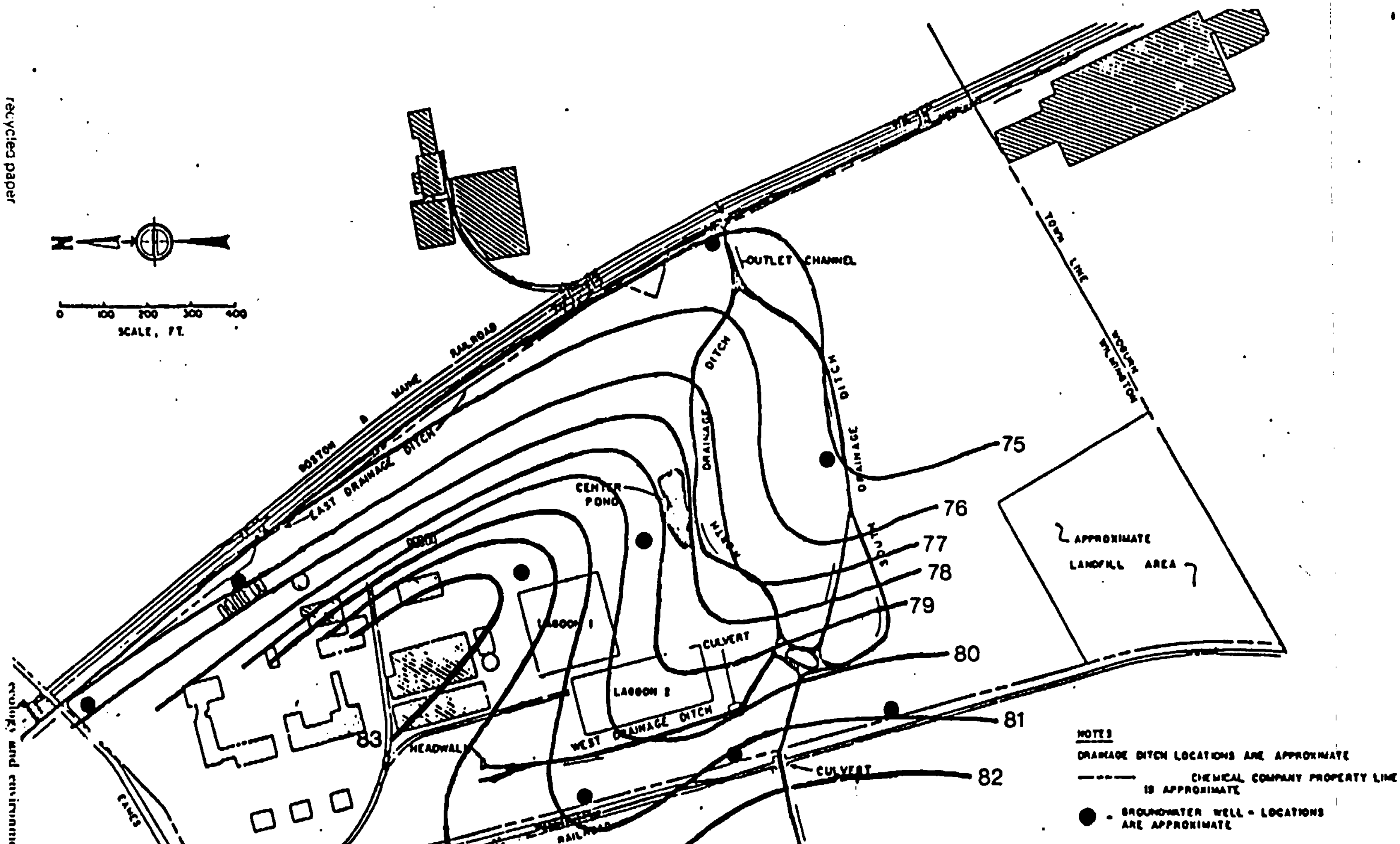


Figure 12 - Groundwater Surface Contour Map Prepared from E & E Site Inspection Data

7. Results of Investigation

7.2 Sampling procedures and screening results:

7.2.1 Groundwater sampling procedures - continued

The following is a summary of the sampling operations and data obtained at each well:

Olin Well GW-1 (Station 001, Sample #70818):
Depth of well: 21' 4"
Depth to water (static level): 11' 4"
Volume purged prior to sampling: 5 gallons
Samples taken: E & E obtained (1) 40 ml VOA vial with 10% head space for screening. Olin representatives obtained 80 ml.

Olin Well GW-5 (Station 002, Sample #70809):
Depth of well: 13' 2 1/2"
Depth to water (static level): 4' 1"
Volume purged prior to sampling: 5 gallons
Samples taken: E & E obtained the following priority pollutant sample:
(2) 1/2 gallon jars with Teflon lined caps for extractables
(2) 40 ml VOA vials for purgeables
(1) 1 liter polyethylene bottle for metals
(1) 40 ml VOA vial with headspace for screening
Olin representatives obtained similar volumes for similar analyses.

Olin Well GW-10 (Station 006, Sample #70816):
Depth of well: 12' 3"
Depth to water (Static level): 8'7"
Volume purged prior to sampling: 3 1/2 gallons
Samples taken: E & E obtained sufficient volume in appropriate containers for priority pollutant

7. Results of Investigation

7.2 Sampling procedures and screening results:

7.2.1 Groundwater sampling procedures - continued

analyses (See description under Well GW-5).
Olin representatives obtained similar volumes for analyses.

Olin Well GW-12 (Station 007, Sample #70825):

Depth of well: 12' 1"
Depth to water (static level): 4' 7"
Volume purged prior to sampling: 3 1/2 gallons
Samples taken: E & E obtained (1) 40 ml VOA vial with 10% head space for screening. Olin representatives obtained 80 ml.
Note: Due to the fact that leaves and other debris were pumped as this well was purged, it is likely that the well casing is broken below the water table.

Olin Well GW-8 (Station 008, Sample #70826):

Depth of well: 10'10"
Depth to water (static level): 5'1"
Volume purged prior to sampling: 3 1/2 gallons
Samples taken: E & E obtained (1) 40 ml VOA vial with 10% headspace for screening. Olin representatives obtained 80 ml.
Note: Water had a brown, murky color throughout the purging and sampling processes.

Olin Well GW-11 (Station 009, Sample #70827):

Depth of well: 15' 9"
Depth to water (static level): 6'3"
Volume purged prior to sampling: 3 1/2 gallons
Samples taken: E & E obtained (1) ml VOA vial with 10% head space for screening. Olin representatives obtained 80 ml.

7. Results of Investigation

7.2 Sampling procedures and screening results:

7.2.1 Groundwater sampling procedures - continued

Olin Well GW-6 (Station 010, Sample #70828):

Depth of well: 15' 1"

Depth to water (Static level): 5'11"

Volume purged prior to sampling: 3 1/2 gallons

Samples taken: E & E obtained (1) 40 ml VOA vial with 10% head space for screening. Olin representatives obtained 80 ml.

Olin Well GW-7 (Station 011, Sample #70811):

Depth of well: 16' 0"

Depth to water (static level): 5'4"

Volume purged prior to sampling: under two gallons

Samples taken: No samples taken.

Note: Well was clogged with wasps.

Olin Well GW-2 (Station 012, Sample #70812)

Depth of well: 16' 9"

Depth to water (static level): 12' 5"

Note: This well was highly contaminated with an oily substance, most likely dioctylphthalate.

Volume prior to sampling: Because of the depth of the well and the high viscosity of the contaminant, it was not possible to obtain more than a quart of material from this well. The intent was to take sufficient volume for a priority pollutant analysis. The volume obtained was split with Olin representatives. The sample was very obviously two-phase, with a top dark brown layer and a bottom aqueous layer.

7. Results of Investigation

7.2 Sampling procedures and screening results:

7.2.2 Surface water and sediment sampling procedures:

With the exception of the priority pollutant surface water sample collected at Station 003, all sediment and surface water samples consisted of (1) 40 ml VOA vial with head space. All sediment samples were collected with a four-inch diameter soil auger. The locations of all sampling stations are shown in Figure 10.

Station 100 - Sample #70824

A sample from the sulfate sludge landfill was taken approximately one foot below the surface. The sample was greyish-white in color and had the consistency of wet clay.

Station 101 - Sample #70817

A mucky sediment sample was taken in the drainage channel approximately six inches below the channel bottom. A surface water sample was also collected at this station. The water was clear and colorless.

Station 102 - Sample #70807

A surface water sample was initially taken. Upon seeing a bubble of material breakout onto the water surface in a rainbow - colored sheen, it was decided to take a sediment sample. The sediment sample was taken approximately six inches below the channel bottom. It was black and impregnated with a thick black oily substance. A heavy rainbow-colored sheen covered the entire drainage channel as oily material seeped to the surface of the water from the hole made by the auger. Another surface water sample was subsequently taken. The water was clear and slightly brownish in color.

Station 103 - Sample #70821

A surface water sample was taken from a large puddle of standing water located in a depression resulting from recent (?) earth movement. The water was clear and colorless.

7. Results of Investigation

7.2 Sampling procedures and screening results:

7.2.2 Surface water and sediment sampling procedures:

Station 104 - Sample #70822

A surface water sample was taken. The water was clear and colorless.

Station 105 - Sample #70823

A surface water sample was taken. The water was clear and colorless.

Station 106 - Sample #99999

A black mucky sediment sample was taken approximately six inches below the surface. The auger hole was allowed to recharge with water and a water sample was subsequently taken. The water was clear and colorless.

Station 107 - Sample #70808

A surface water sample was taken. The water was clear and colorless and was moving swiftly in the channel.

Station 108 - Sample #70810

A sandy, grey-colored, water soaked sediment sample was taken approximately four feet below the ground surface. Material above the sample location was light-tan, coarse grained sand.

Station 109 - Sample #99998

A black, mucky sediment sample was taken approximately six inches below the surface. The entire area where this sample was taken was resilient when jumped upon. The collected sample had the odor of fuel oil.

Station 110 - Sample #99997

A dark, fine-grained soil sample was collected approximately six inches below the ground surface.

7. Results of Investigation

7.2 Sampling procedures and screening results:

7.2.2 Surface water and sediment sampling procedures:

Station 003 - Sample #70803

A priority pollutant sample was taken of the surface water. There was a thin sheen on the surface of the water. The water was clear and colorless.

Station 004 - Sample #70814

A sample was taken of the standing water at the outlet of the culvert. The water which was clear and colorless was covered with the thick sheen.

Station 005 - Sample #70815

A sample was taken of the surface water. It was clear and colorless.

7.2.3 Screening results of surface water and groundwater samples

The samples specified below were screened on a Century Portable Gas Chromatograph using a T-12 column. All samples were shaken vigorously for two minutes and allowed to reach ambient temperature. 250 microliters (ul) of the headspace vapor were then withdrawn and injected directly into the detector to measure the total volatile hydrocarbon content. Those samples showing volatiles were then run again, but in the gas chromatograph mode. The results follow:

Olin Well GW-1 - Sample #70818

Large methane peak, followed by smaller, fast second peak - unidentified, possibly a higher alkane

Olin Well GW-5 - Sample #70809

Methane peak, no other volatiles within detection limit pH of sample = 6-8. Sample submitted for priority pollutant analysis.

Ol[illegible] Well GW-10 - Sample #70816

[illegible]arge methane peak, followed by smaller, fast second peak [illegible] unidentified, possibly a higher alkane. Sample [illegible]ubmitted for priority pollutant analysis.

7. Results of Investigation

7.2 Sampling procedures and screening results - continued

7.2.3 Screening results of surface water and groundwater samples

Olin Well GW-12 - Sample #70825

No volatiles present within detection limits. pH of sample = 6-8.

Olin Well GW-8 - Sample #70826

No volatiles present within detection limits. pH of sample 4-6.

Olin Well GW-11 - Sample #70827

Large methane peak, followed by smaller, fast second peak - unidentified, possibly a higher alkane.

Olin Well GW-6 - Sample #70828

Methane peak, followed by small fast peak - unidentified, possibly a higher alkane.

Olin Well GW-7 - Not analyzed

No sample obtained

Olin Well GW-2 - Not analyzed

Olin has confirmed presence of dioctylphthalate in the well.

Olin/West End of Central Pond - Sample #70822

No volatiles within detection limits. pH = 6-8

Olin/Jewel Drive side of culvert - Sample #70817

No volatiles within detection limits. pH = 6-8

Olin/Channel near well #5 - Sample #70803

Methane, then very small second peak - not identified. Sample su[illegible]ted for priority pollutant analysis.

7. Results of Investigation

7.2 Sampling procedures and screening results - continued

7.2.3 Screening results of surface water and groundwater samples

Olin/Culvert southeast of sulfate lagoon - Sample #70807

Methane, then very small second peak - not identified.

Olin/East End of Central pond - Sample #70823

No volatiles present within detection limits. pH of sample 6-8.

Olin/Non Contact Cooling Water - west end of warehouse - Sample #70810

Methane present.

Olin/North Drainage Ditch - Sample #70815

Methane present. No other volatiles within detection limit. pH = 6-8.

Olin Standing Water near Well GW-12 - Sample #70821

No volatiles present within detection limits. pH = 6-8

Olin/Surface Water near vegetative stress area - Sample #99999

No volatiles present within detection limits. pH = 6-8.

7.2.4 Screening results of soil and sediment samples.

An attempt will be made to analyze for the presence of volatile vapors in these samples by allowing the samples to reach room temperature and injecting a portion of the head space vapor into the portable GC. Since the column of the portable GC operates at ambient temperature, it is not practical to heat up the sediment samples to drive off vapor, as the vapor might condense in the column and thereby destroy the column.

7. Results of Investigation

7.2 Sampling procedures and screening results - continued

7.2.5 Photographs of Sampling Points

Figures 13 through 30 are photographs of the sampling locations.

8. Recommendations:

E & E has made arrangements with Olin to collect a priority pollutant sample at Well GW-2 to determine the extent of contamination. A pump capable of sampling this well is on order. With this exception, no additional on-site inspection or sampling activity of this site is warranted at this time. Should the priority pollutant analyses indicate unanticipated contamination, the need for re-entry will be evaluated.

The East Drainage Ditch should be examined regularly to determine if the absorbant pads now in place are preventing the entry of phthalates, amines and phenols into the ditch. There is an obvious need for remedial action to eliminate the ongoing contamination of a Class B stream (East Drainage Ditch) with priority pollutants including dioctylphthalate and possibly diphenyl hydrazine as well as various phenols and amines.

To avoid repeated spills of hazardous materials from the tank farm, it is recommended that an impervious base and confinement structure be provided.

The release of heavy fuel oil from oil impregnated soil into the North Drainage Ditch is taking place. The placing of absorbant pads at the entrance of this ditch into the East Drainage Ditch is recommended.

9. Conclusions:

The seepage from Olin property of at least one priority pollutant (dioctylphthalate) into a Class B stream is presently occurring.

This contamination is very likely entering the Aberjona River by way of Halls' Brook Storage Area.

A monitoring well located on Olin property is grossly contaminated with at least one priority pollutant.

There is extensive contamination of soil on Olin property with heavy residual oil.

A completed Potential Hazardous Waste Site - Site Inspection Report is included in Appendix B.

Figure 13: Sampling Station 001

Figure 14: Sampling Station 002

Wilmington F. EPA Site Insp.

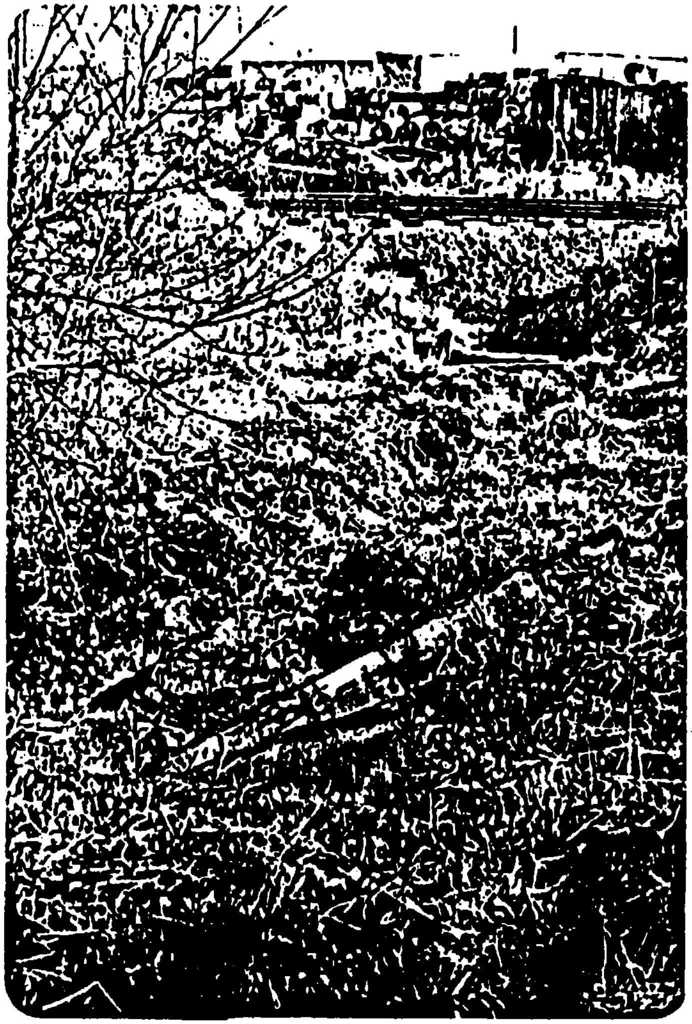


Figure 15: Sampling Station 003

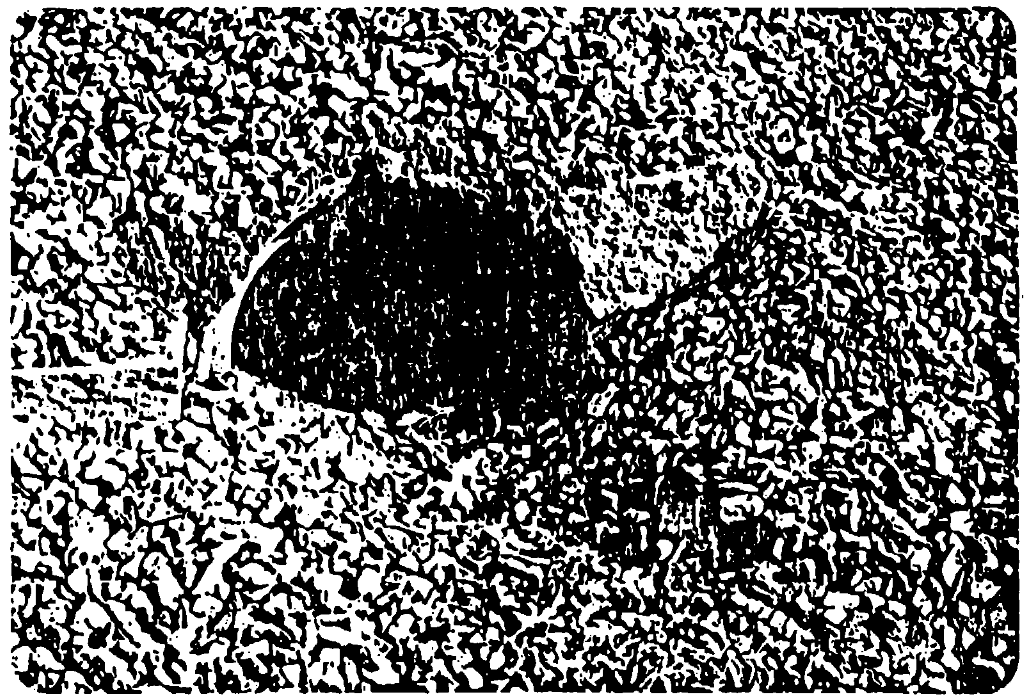


Figure 16: Sampling Station 004

Figure 17: Sampling Station 005

Figure 18: Sampling Station 006

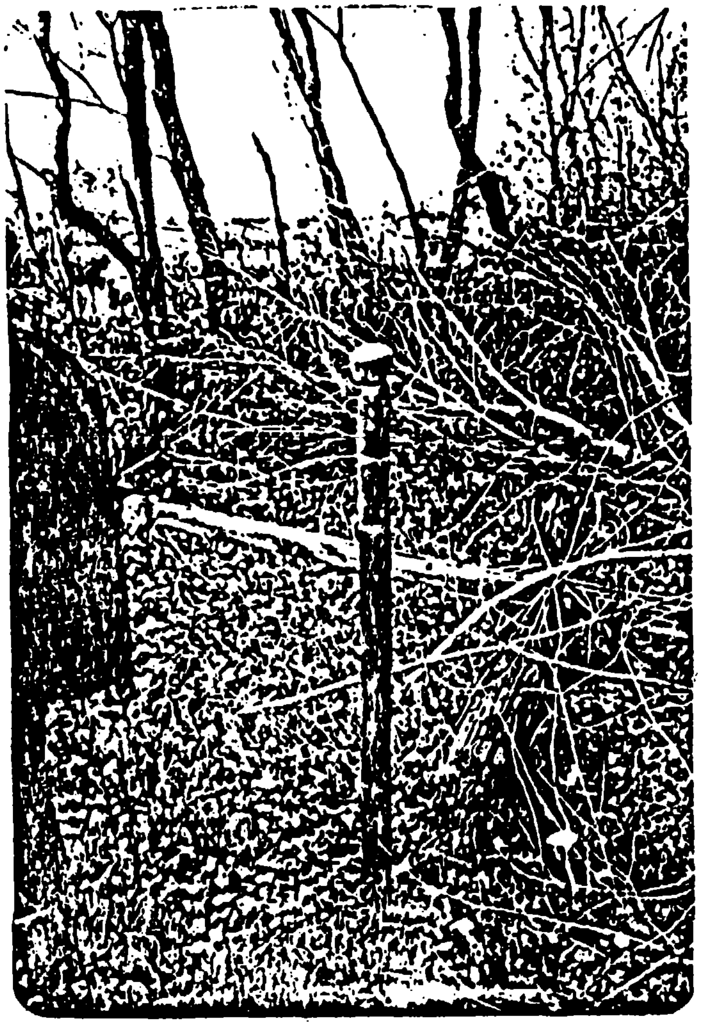


Figure 19: Sampling Station 007

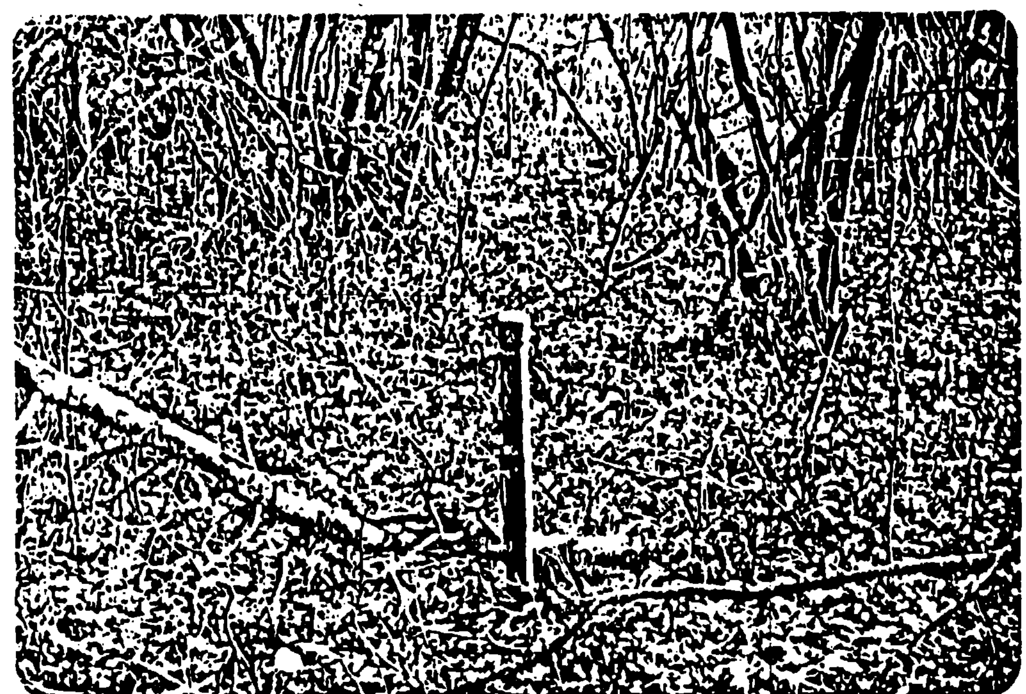


Figure 20: Sampling Station 008

Figure 21: Sampling Station 009

Figure 22: Sampling Station 010

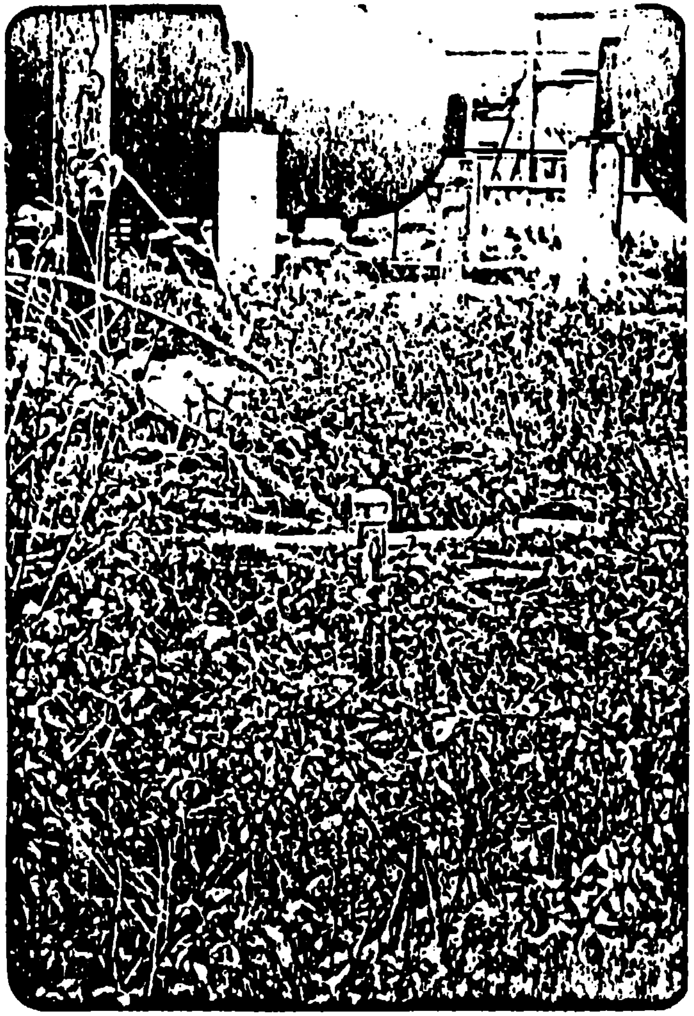


Figure 23: Sampling Station 012

Figure 24: Sampling Station 102

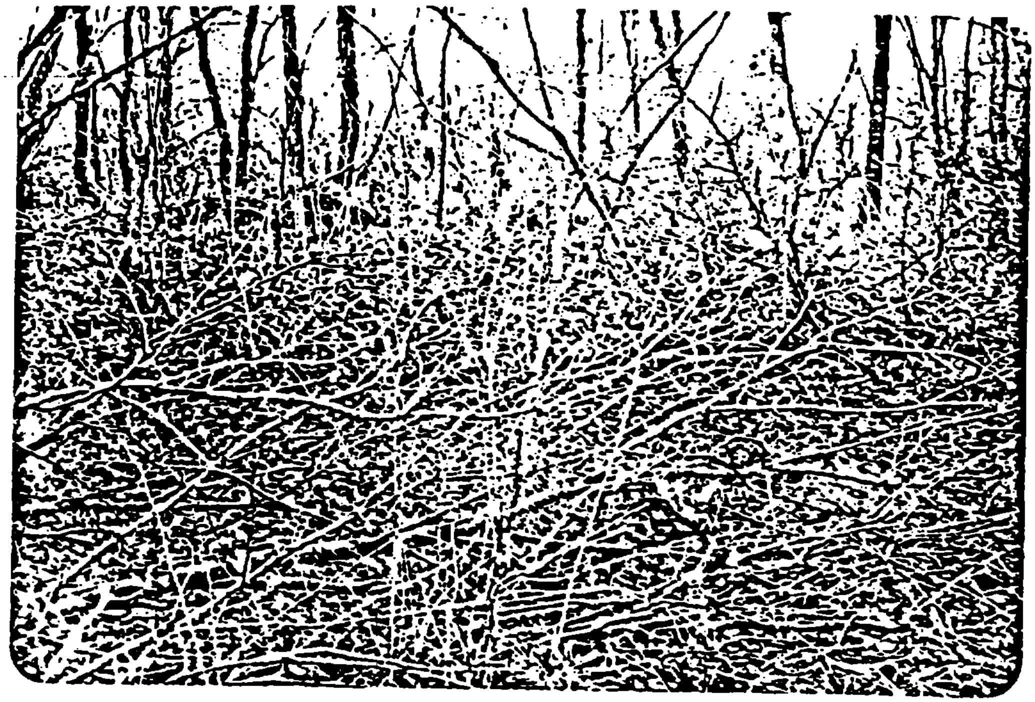


Figure 25: Sampling Station 103

Figure 26: Sampling Station 104

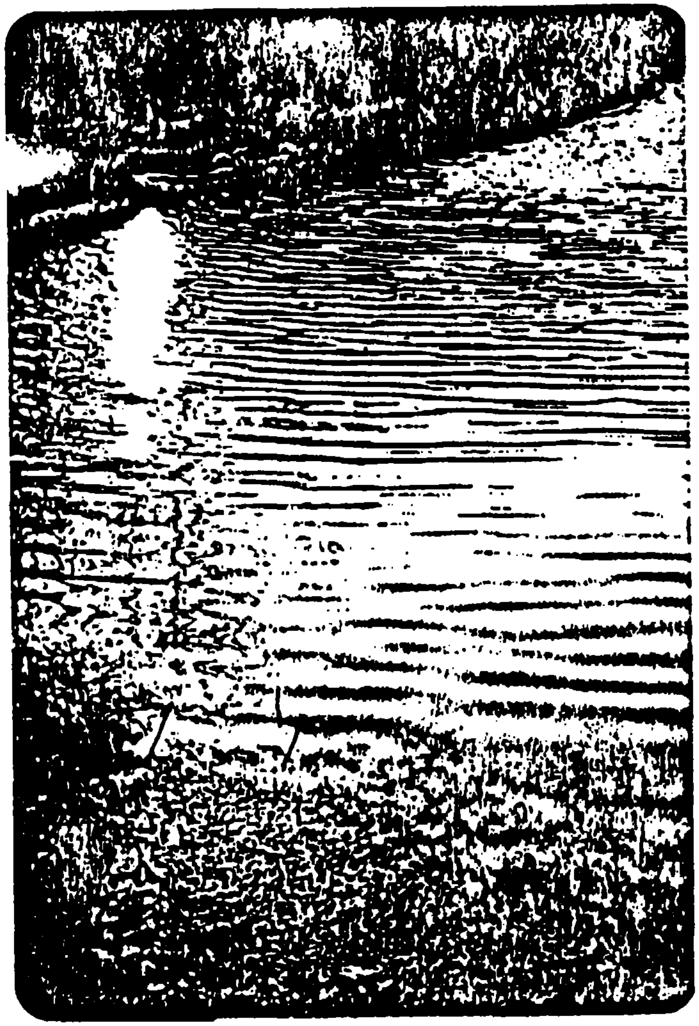


Figure 27: Sampling Station 105

Figure 28: Sampling Station 106

Figure 29: View toward the northwest from Sampling Station 106

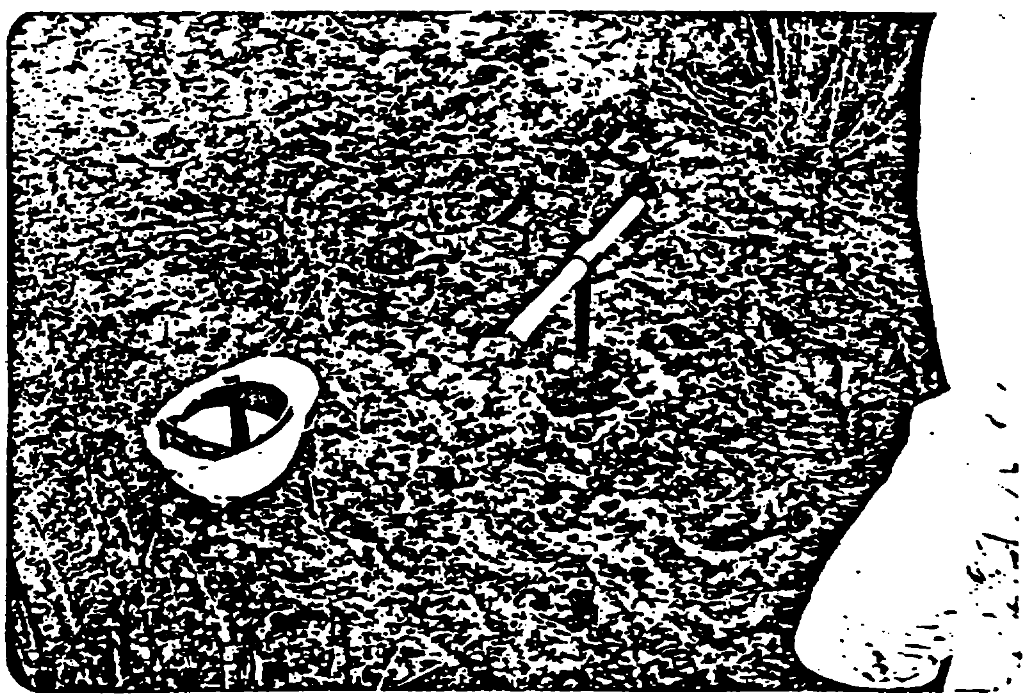


Figure 30: Sampling Station 108

APPENDIX A

SITE SAFETY PLAN

and

REPORT

SITE SAFETY PLAN

ITE: Olin Chemicals Group Plant DATE: 10/23/80 TDD #: 1-80

OCATION: Eames Street, Wilmington, MA PREPARED BY: Fucarile/Desmarais

NVESTIGATIVE OBJECTIVE(S): To gather information necessary to determine the potential for R and/or 311/104 Clean Water Act action PROPOSED DATE OF INVESTIGATION: 11/5

ACKGROUND REVIEW: Complete: x Preliminary: ___

OCUMENTATION/SUMMARY: OVERALL HAZARD: Serious ___ Moderate x Low ___ U

SITE/WASTE CHARACTERISTICS

ASTE TYPE(S): Liquid x Solid x Sludge x Gas ___

HARACTERISTIC(S): Corrosive x Ignitable ___ Radioactive ___ Volatile x Toxic ___ React. ___ Unk. _

ACILITY DESCRIPTION: Size: 53 acres Buildings: approx. 7 buildings 11 storage tanks, 12 wells

Topography: embankment to ditch at RR tracks, marshland at back of property

Principal Disposal method (type and location): formerly three acid pits, now rectang settling basins used for gypsum containment, storage tanks

Unusual Features (dike integrity, power lines, terrain, etc.) boardered by B&M RR tra

Status: (open, closed, unknown) op

HISTORY: (worker or non-worker injury; complaints from public; previous agency action):

Analysis of sludge Nat'l Polychemicals, Inc. 1970 leaching into Aberjona. Geotechnical Engineers Study PVC liner leaks in 1979, Complaints to MDC regarding high chloride, sulfat and ammonia levels in sewer. Former Stepan employee unofficially reported phosphorus tric dumped on ground and residues buried near wetlands. He was taken to hospital for oxygen because he was overcome by ammonia fumes inside building.

HAZARD EVALUATION

Moderate Hazard, After close examination of the Geotech. Study, Nat'l Polychemical Study e The only priority pollutants presumed to be on site are toluene and dioctylphalate. It is highly likely that toluene would have volatilized soon after a spill. Dioctylphalate is n a vapor hazard. Toluene could be a vapor hazard if it is leaking. Ultra twins should be Also, could have acidic or basic leachates thus rubber gloves and boots and apron protecti Eye protection taken care of by Ultra Twin masks. Other non priority pollutants which may be on site could be ingestion hazards; therefore, reasonable hygene should be practiced.

ECOLOGY AND ENVIRONMENT, INC.

FIELD INVESTIGATION TEAM - REGION I

WORK PLAN INSTRUCTIONS

I. PERIMETER ESTABLISHMENT: Map/Sketch Attached x [c] Site Control ____
Public Perimeter Identified x Zone(s) of Contamination Identified x
NOTES:

[c] areas of special safety concern identified

II. PERSONAL CLOTHING:
Level of Protection: A ____ B ____ C x D ____
Modifications: ____

Surveillance Equipment and Materials: TLD badges

II. DECONTAMINATION PROCEDURES:
Hot Line Location (initial): at public perimeter access
Command Post Location (initial): at public perimeter access
PDS Stations: 1. boot & glove wash 2. boot & glove rinse
3. ____ 4. ____ 5. ____
Equipment and Materials/Special Facilities: ____

IV. SITE ENTRY PROCEDURES:
Team Size: E & E 5 State ____ Other ____
Entry Briefing (date) day before site entry
Station Designation (name/responsibility): 1. Dave Cook, Project Leader
2. Paul Clay, Equipment/Work party 3. Lori Fucarile, Safety
4. Robert Palermo, Work party 5. Paul Exner, Work party
6. ____ 7. ____
Work Schedule/Limitations:
Site entry team will not be entering any buildings. Entry to (outside) area will be only after receiving permission from Olin Chemical.
Notes:

SITE SAFETY PLAN SUMMARY

NAME OF SITE: Olin Chemical Group DATE: 10/23/80

TDD #: F-1-8005-01F

Location of site: Eames Street, Wilmington, MA

Directions to site: Washington Street North to West Street. Left on Industria Way, right on Woburn Ave., then left on Eames Street.

Project Leader/Site Entry Leader: David Cook

Safety Person: Lori Fucarile

Equipment Person: Paul Clay

Work Party: Paul Clay, David Cook, Palermo, Paul Exner

Reason for Site Entry: to determine potential for RCRA/311/104 action

Special Hazards: Volatile hydrocarbons may be present; acid or base mav be pre

Hazard Assessment: (H, M, L, Unk.) Moderate, High levels of contaminants not expected

Level of Protection: Level C

Required Protective Equipment:

1. Ultra Twin w/cartridge
2. Robert Shaw
3. Tyveks (Chem. Resistant)
4. Gloves
5. boots
6. hard hats
7. TLD badges
8. Butyl rubber aprons
9. Explosimeter
10. O_2 Meter

recycled paper ecology and environment, inc.

WORK PLAN INSTRUCTIONS - continued

V. EMERGENCY PRECAUTIONS:

ACUTE EXPOSURE SYMPTOMS	FIRST AID
Volatile hydrocarbon exposure: lightheadedness, nausea	Get to fresh air, administer oxygen if required. Seek medical aid

HOSPITALS/POISON CONTROL CENTERS (address, telephone number)

See Resources List

EMERGENCY TRANSPORTATION SYSTEMS (Fire, police, ambulance)

See Resources List

VI. EMERGENCY ROUTES

Choate Hospital, Left from Olin gate onto Eames St. to Route 38, left on 38 (Main Street) straight (Under 128) to Woburn Center approx 1.5 miles to Warren Ave. Choate Hospital is at top of hill.

EQUIPMENT CHECKOUT

SCBA		Cylinders		Eye Wash Unit	
Ultratwin	x	Cartridges	x	First Aid Kit	
Explosimeter			x	Drinking Water Supply	
O_2 Indicator			x	Personal Clothing	
Draeger Pump	x	Tubes	x	Decontamination Mat'ls.	
Radiation Survey Meter					

ECOLOGY AND ENVIRONMENT INC. - REGION I

SITE: Olin Chemical Group Plant TDD #: F-1-8005-01F DATE: 10/23/80

RESOURCES
(locate resources on area map)

	NAME	TOWN	PHONE	NOTIFIED YES/NO
FIRE	Wilmington	Wilmington	658-3200	no
POLICE	Wilmington	Wilmington	658-3200	no
AMBULANCE	Wilmington	Wilmington	658-3200	no
HOSPITAL ER	Choate Hospital	Warren Ave., Woburn	933-6700	no
WATER SUPPLY	on van			
TELEPHONE	Olin Chemical	Eames St, Wilmington, MA	933-4240	yes
RADIO COMMUNICATIONS	NA			
AIRPORT	NA			
HELIPORT AREA	NA			
EXPLOSIVES UNIT	State Police	S. Lynnfield	593-1122	no
EPA CONTACT	Rick Leighton	Lexington/NERL	861-6700	yes

LIST OTHER RESOURCES:

EMERGENCY NUMBERS

E & E, Inc., Woburn	(617) 935-0228	(0238) (4008)
E & E, Inc. Arlington, VA	(703) 522-6065	24 hr. number - call forwarding
Dr. Harbison - Vanderbilt	(615) 322-4754	
Dr. Harbison - home	(615) 747-6353	24 hr. number - 9 second message
Robert Young - home	(617) 545-4905	
Anne Marie Desmarais - home	(617) 897-5306	
Peter Bent Brigham, Occup. Ind. Health Clinic:		
Dr. Speizer, Dr. Shenker, Kay Jordan	(617) 732-5983	
24 hour number - ask for bellboy 904	(617) 732-6000	

ECOLOGY AND ENVIRONMENT, INC.
FIELD INVESTIGATION TEAM - REGION I

SITE SAFETY REPORT

NAME OF SITE: Olin Chemicals Group DATE OF ENTRY: 11/12/80
TDD #: F-1-8005-01F

Reason for Site Entry: To obtain information and samples for possible RCRA and/or 311/104 Clean Water Act actions regarding Olin Chemicals Group.

Personnel on Site:
Site Entry Leader: David Cook
Safety Person: Lori Fucarile
Equipment Person: Paul Clay
Work Party: Paul Clay, Glenn Smart, Margret Hanley, Richard DiNitto

Other E & E Personnel:

Other Personnel on Site: Ted Groom, M. Ahsah, and D.Vaughn (Olin Research)

Explain Any YES Answer on an Attached Sheet:	YES	NO
1. Was the Safety Plan followed as presented? Explain any and all deviations in full.	x	
2. Did any team member report chemical exposure?		x
3. Did any team member report illness, discomfort, or unusual symptoms?		x
4. Did any team member report environmental problems? (heat, cold, etc.)		x
5. Did any team member report injury?		x
6. Did the site entry have to be curtailed for any reason? (rain, lack of air, etc.)		x
7. Were any emergency services or resources utilized?		x
8. Were there any unusual occurences?		x
9. Was the Safety Plan adequate?	x	

10. What changes would you recommend? None

APPENDIX B

POTENTIAL HAZARDOUS WASTE SITE

SITE INSPECTION REPORT

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

REGION	SITE NUMBER (to be assigned by Hq)
I	

GENERAL INSTRUCTIONS: Complete Sections I and III through XV of this form as completely as possible. Then use the information on this form to develop a Tentative Disposition (Section II). File this form in its entirety in the regional Hazardous Waste Log File. Be sure to include all appropriate Supplemental Reports in the file. Submit a copy of the forms to: U.S. Environmental Protection Agency; Site Tracking System; Hazardous Waste Enforcement Task Force (EN-335); 401 M St., SW; Washington, DC 20460.

I. SITE IDENTIFICATION

A. SITE NAME: Olin Chemicals Group-Wilmington Plant
B. STREET (or other identifier): Eames Street
C. CITY: Wilmington
D. STATE: MA
E. ZIP CODE: 01887
F. COUNTY NAME: Middlesex

G. SITE OPERATOR INFORMATION
1. NAME: Mr. Ron McBrien (Plant Manager)
2. TELEPHONE NUMBER: 933-4240
3. STREET: Eames Street
4. CITY: Wilmington
5. STATE: MA
6. ZIP CODE: 01887

H. REALTY OWNER INFORMATION (if different from operator of site)
1. NAME: N/A
2. TELEPHONE NUMBER:
3. CITY:
4. STATE:
5. ZIP CODE:

I. SITE DESCRIPTION
Complex of Chemical Process Buildings on a large wooded lot

J. TYPE OF OWNERSHIP
☐ 1. FEDERAL ☐ 2. STATE ☐ 3. COUNTY ☐ 4. MUNICIPAL ☒ 5. PRIVATE

II. TENTATIVE DISPOSITION (complete this section last)

A. ESTIMATE DATE OF TENTATIVE DISPOSITION (mo., day, & yr.):

B. APPARENT SERIOUSNESS OF PROBLEM
☐ 1. HIGH ☒ 2. MEDIUM ☐ 3. LOW ☐ 4. NONE

C. PREPARER INFORMATION
1. NAME: David K. Cook
2. TELEPHONE NUMBER: 935-4008
3. DATE (mo., day, & yr.): 12/4/80

III. INSPECTION INFORMATION

A. PRINCIPAL INSPECTOR INFORMATION
1. NAME: David K. Cook
2. TITLE: Sr. Geological Engineer
3. ORGANIZATION: Ecology and Environment, Inc. (E&E)
4. TELEPHONE NO. (area code & no.): 617-935-4008

B. INSPECTION PARTICIPANTS

1. NAME	2. ORGANIZATION	3. TELEPHONE NO.
David K. Cook	Ecology and Environment, Inc.	935-4008
Paul Clay	Ecology and Environment, Inc.	935-4008
Richard DiNitto	Ecology and Environment, Inc.	935-4008
Margret Hanley	Ecology and Environment, Inc.	935-4008
William Norman	Ecology and Environment, Inc.	935-4008
Glenn Smart	Ecology and Environment, Inc.	935-4008
Lori Fucarile	Ecology and Environment, Inc.	935-4008

C. SITE REPRESENTATIVES INTERVIEWED (corporate officials, workers, residents)

1. NAME	2. TITLE & TELEPHONE NO.	3. ADDRESS
David Vaughn	Environmental Coordinator 203-356-3156	Hartford, CT
Ted Groom	Chemist 203-356-3156	Hartford, CT
M. Ahsah	Chemist 933-4240	Wilmington, MA

Continued From Front

III. INSPECTION INFORMATION *(continued)*

D. GENERATOR INFORMATION *(sources of waste)*

1. NAME	2. TELEPHONE NO.	3. ADDRESS	4. WASTE TYPE GENERATE
Olin		Wilmington	Chemicals associat with rubber blowin agent manufacture

E. TRANSPORTER/HAULER INFORMATION

1. NAME	2. TELEPHONE NO.	3. ADDRESS	4. WASTE TYPE TRANSPORTI
N/A			

F. IF WASTE IS PROCESSED ON SITE AND ALSO SHIPPED TO OTHER SITES, IDENTIFY OFF-SITE FACILITIES USED FOR DISPOSAL.

1. NAME	2. TELEPHONE NO.	3. ADDRESS
N/A		

G. DATE OF INSPECTION *(mo., day, & yr.)*	H. TIME OF INSPECTION	I. ACCESS GAINED BY: *(credentials must be shown in all cases)*
11/12/80	0900-1630	☒ 1. PERMISSION ☐ 2. WARRANT

J. WEATHER *(describe)*

Clear/Cold

IV. SAMPLING INFORMATION

A. Mark 'X' for the types of samples taken and indicate where they have been sent e.g., regional lab, other EPA lab, contractor, etc. and estimate when the results will be available.

1. SAMPLE TYPE	2. SAMPLE TAKEN *(mark 'X')*	3. SAMPLE SENT TO:	4. DATE RESULTS AVAILABLE
a. GROUNDWATER	X	Regional lab (2 priority)	1/10/81
b. SURFACE WATER	X	Regional lab (1 priority)	1/10/81
c. WASTE			
d. AIR			
e. RUNOFF			
f. SPILL			
g. SOIL	X	Regional lab	1/10/81
h. VEGETATION			
i. OTHER *(specify)*			

B. FIELD MEASUREMENTS TAKEN *(e.g., radioactivity, explosivity, PH, etc.)*

1. TYPE	2. LOCATION OF MEASUREMENTS	3. RESULTS
Explosivity	Various	Consistently 0
O_2 Meter	Various	Consistently 20
pH	All Well Samples	6-8

Continued From Page 2

IV. SAMPLING INFORMATION (continued)

C. PHOTOS

1. TYPE OF PHOTOS: [X] a. GROUND [X] b. AERIAL
2. PHOTOS IN CUSTODY OF: E&E

D. SITE MAPPED?

[X] YES. SPECIFY LOCATION OF MAPS: E&E

E. COORDINATES

1. LATITUDE (deg.-min.-sec.): 42° 31' 50"
2. LONGITUDE (deg.-min.-sec.): 71° 9' 30"

V. SITE INFORMATION

A. SITE STATUS

[X] 1. ACTIVE *(Those industrial or municipal sites which are being used for waste treatment, storage, or disposal on a continuing basis, even if infrequently.)*

[ ] 2. INACTIVE *(Those sites which no longer receive wastes.)*

[ ] 3. OTHER(specify): *(Those sites that include such incidents like "midnight dumping" where no regular or continuing use of the site for waste disposal has occurred.)*

B. IS GENERATOR ON SITE?

[ ] 1. NO [X] 2. YES(specify generator's four-digit SIC Code): 2821

C. AREA OF SITE (in acres): 53

D. ARE THERE BUILDINGS ON THE SITE?

[ ] 1. NO [X] 2. YES(specify): approx. 20 Process Buildings

VI. CHARACTERIZATION OF SITE ACTIVITY

Indicate the major site activity(ies) and details relating to each activity by marking 'X' in the appropriate boxes.

X	A. TRANSPORTER	X	B. STORER	X	C. TREATER	X	D. DISPOSER
		X		X			
	1. RAIL		1. PILE		1. FILTRATION		1. LANDFILL
	2. SHIP		2. SURFACE IMPOUNDMENT		2. INCINERATION		2. LANDFARM
	3. BARGE		3. DRUMS		3. VOLUME REDUCTION		3. OPEN DUMP
	4. TRUCK	X	4. TANK, ABOVE GROUND		4. RECYCLING/RECOVERY	X	4. SURFACE IMPOUNDMENT
	5. PIPELINE		5. TANK, BELOW GROUND	X	5. CHEM./PHYS./TREATMENT		5. MIDNIGHT DUMPING
	6. OTHER(specify):		6. OTHER(specify):		6. BIOLOGICAL TREATMENT		6. INCINERATION
					7. WASTE OIL REPROCESSING		7. UNDERGROUND INJECTION
					8. SOLVENT RECOVERY		8. OTHER(specify): Possible buried drums
					9. OTHER(specify):		

E. SUPPLEMENTAL REPORTS: If the site falls within any of the categories listed below, Supplemental Reports must be completed. Indicate which Supplemental Reports you have filled out and attached to this for..

[X] 1. STORAGE [ ] 2. INCINERATION [ ] 3. LANDFILL [ ] 4. SURFACE IMPOUNDMENT [ ] 5. DEEP WELL

[ ] 6. CHEM/BIO/PHYS TREATMENT [ ] 7. LANDFARM [ ] 8. OPEN DUMP [ ] 9. TRANSPORTER [ ] 10. RECYCLOR/RECLAIMER

VII. WASTE RELATED INFORMATION

A. WASTE TYPE

[X] 1. LIQUID [ ] 2. SOLID [X] 3. SLUDGE [ ] 4. GAS

B. WASTE CHARACTERISTICS

[X] 1. CORROSIVE [ ] 2. IGNITABLE [ ] 3. RADIOACTIVE [X] 4. HIGHLY VOLATILE

[X] 5. TOXIC [ ] 6. REACTIVE [X] 7. INERT [ ] 8. FLAMMABLE

[ ] 9. OTHER(specify):

C. WASTE CATEGORIES

1. Are records of wastes available? Specify items such as manifests, inventories, etc. below.

Yes-inventories

Continue On Reverse

Continued From Front

VII. WASTE RELATED INFORMATION *(continued)*

2. Estimate the amount *(specify unit of measure)* of waste by category; mark 'X' to indicate which wastes are present.

a. SLUDGE	b. OIL	c. SOLVENTS	d. CHEMICALS	e. SOLIDS	f. OTHER
AMOUNT	AMOUNT UNK	AMOUNT	AMOUNT UNK	AMOUNT	AMOUNT
UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE
'X'	'X'	'X'	'X'	'X'	'X'
(1) PAINT, PIGMENTS	X (1) OILY WASTES	(1) HALOGENATED SOLVENTS	X (1) ACIDS	(1) FLYASH	(1) LABORATORY, PHARMACEUT.
(2) METALS SLUDGES	(2) OTHER*(specify)*:	(2) NON-HALOGNTD. SOLVENTS	(2) PICKLING LIQUORS	(2) ASBESTOS	(2) HOSPITAL
(3) POTW		(3) OTHER*(specify)*:	(3) CAUSTICS	(3) MILLING/MINE TAILINGS	(3) RADIOACTIVE
(4) ALUMINUM SLUDGE			(4) PESTICIDES	(4) FERROUS SMELTING WASTES	(4) MUNICIPAL
(5) OTHER*(specify)*:			(5) DYES/INKS	(5) NON-FERROUS SMLTG. WASTES	(5) OTHER*(specify)*:
			(6) CYANIDE	(6) OTHER*(specify)*:	
			X (7) PHENOLS		
			(8) HALOGENS		
			(9) PCB		
			(10) METALS		
			(11) OTHER*(specify)*: Phthalates Amines		

D. LIST SUBSTANCES OF GREATEST CONCERN WHICH ARE ON THE SITE *(place in descending order of hazard)*

1. SUBSTANCE	2. FORM *(mark 'X')*			3. TOXICITY *(mark 'X')*				4. CAS NUMBER	5. AMOUNT	6. UNIT
	a. SOLID	b. LIQ.	c. VAPOR	a. HIGH	b. MED.	c. LOW	d. NONE			
Dioctylphthalate		X				X			15000	gal.
Diphenolamine		X			X				UNK	
Dioctylamine		X			X				UNK	
Nonyl & DiNonyl Phenol		X			X				16700	gal.
Acids - Sulfuric		X		X					UNK	
Phosphorus Trichloride		X	X	X					UNK	

VIII. HAZARD DESCRIPTION

FIELD EVALUATION HAZARD DESCRIPTION: Place an 'X' in the box to indicate that the listed hazard exists. Describe the hazard in the space provided.

[X] A. HUMAN HEALTH HAZARDS

From phthalates & phenols in East Drainage Ditch

Continued From Page 4

VIII. HAZARD DESCRIPTION *(continued)*

[X] B. NON-WORKER INJURY/EXPOSURE

See A

[ ] C. WORKER INJURY/EXPOSURE

[ ] D. CONTAMINATION OF WATER SUPPLY

[ ] E. CONTAMINATION OF FOOD CHAIN

[X] F. CONTAMINATION OF GROUND WATER

Phthalates & Phenols & amines in monitoring wells

[X] G. CONTAMINATION OF SURFACE WATER

Phthalates & Phenols & amines seeping into East Drainage Ditch

Continued From Front

VIII. HAZARD DESCRIPTION *(continued)*

[X] H. DAMAGE TO FLORA/FAUNA

Large areas of dead trees on Olin property

[ ] I. FISH KILL

[ ] J. CONTAMINATION OF AIR

[ ] K. NOTICEABLE ODORS

[X] L. CONTAMINATION OF SOIL

Seepage of phthalates, amines & phenols into soil

[ ] M. PROPERTY DAMAGE

Continued From Page 6

VIII. HAZARD DESCRIPTION (continued)

☐ N. FIRE OR EXPLOSION

☒ O. SPILLS/LEAKING CONTAINERS/RUNOFF/STANDING LIQUID

Leaking tanks caused the surface water and groundwater contamination

☐ P. SEWER, STORM DRAIN PROBLEMS

☐ Q. EROSION PROBLEMS

☐ R. INADEQUATE SECURITY

☐ S. INCOMPATIBLE WASTES

VIII. HAZARD DESCRIPTION (continued)

☐ T. MIDNIGHT DUMPING

☐ U. OTHER (specify):

IX. POPULATION DIRECTLY AFFECTED BY SITE

A. LOCATION OF POPULATION	B. APPROX. NO. OF PEOPLE AFFECTED	C. APPROX. NO. OF PEOPLE AFFECTED WITHIN UNIT AREA	D. APPROX. NO. OF BUILDINGS AFFECTED	E. DISTANCE TO SITE (specify units)
1. IN RESIDENTIAL AREAS	?	?	Aberjona Riv.	1 Mile
2. IN COMMERCIAL OR INDUSTRIAL AREAS	N/A			
3. IN PUBLICLY TRAVELLED AREAS	N/A			
4. PUBLIC USE AREAS (parks, schools, etc.)	?	?	Aberjona Riv.	1 Mile

X. WATER AND HYDROLOGICAL DATA

A. DEPTH TO GROUNDWATER (specify unit)	B. DIRECTION OF FLOW	C. GROUNDWATER USE IN VICINITY
approx. 10	SE	Industrial
D. POTENTIAL YIELD OF AQUIFER	**E. DISTANCE TO DRINKING WATER SUPPLY (specify unit of measure)**	**F. DIRECTION TO DRINKING WATER SUPPLY**
> 3 MGD	5 miles	S

G. TYPE OF DRINKING WATER SUPPLY

☐ 1. NON-COMMUNITY < 15 CONNECTIONS ☒ 2. COMMUNITY (specify town): Woburn > 15 CONNECTIONS

☐ 3. SURFACE WATER ☒ 4. WELL

 Continue On Page 9

Continued From Page 8

X. WATER AND HYDROLOGICAL DATA (continued)

H. LIST ALL DRINKING WATER WELLS WITHIN A 1/4 MILE RADIUS OF SITE

1. WELL	2. DEPTH (specify unit)	3. LOCATION (proximity to population/buildings)	4. NON-COMMUNITY (mark 'X')	5. COMMUNITY (mark 'X')
None				

I. RECEIVING WATER

1. NAME: Aberjona River

☐ 2. SEWERS ☒ 3. STREAMS/RIVERS ☐ 4. LAKES/RESERVOIRS ☐ 5. OTHER (specify):

6. SPECIFY USE AND CLASSIFICATION OF RECEIVING WATERS

Class B Stream being directly contaminated. Water unused

XI. SOIL AND VEGITATION DATA

LOCATION OF SITE IS IN:

☐ A. KNOWN FAULT ZONE ☐ B. KARST ZONE ☐ C. 100 YEAR FLOOD PLAIN ☐ D. WETLAND

☐ E. A REGULATED FLOODWAY ☐ F. CRITICAL HABITAT ☐ G. RECHARGE ZONE OR SOLE SOURCE AQUIFER

XII. TYPE OF GEOLOGICAL MATERIAL OBSERVED

Mark 'X' to indicate the type(s) of geological material observed and specify where necessary, the component parts.

'X'	A. OVERBURDEN	'X'	B. BEDROCK (specify below)	'X'	C. OTHER (specify below)
X		X			
X	1. SAND		Bedrock near surface		
X	2. CLAY		at southern end of site near landfill		
	3. GRAVEL				

XIII. SOIL PERMEABILITY

☒ A. UNKNOWN ☐ B. VERY HIGH (100,000 to 1000 cm/sec.) ☐ C. HIGH (1000 to 10 cm/sec.)

☐ D. MODERATE (10 to .1 cm/sec.) ☐ E. LOW (.1 to .001 cm/sec.) ☐ F. VERY LOW (.001 to .00001 cm/sec.)

G. RECHARGE AREA

☐ 1. YES ☒ 2. NO 3. COMMENTS:

H. DISCHARGE AREA

☒ 1. YES ☐ 2. NO 3. COMMENTS:

I. SLOPE

1. ESTIMATE % OF SLOPE: ?

2. SPECIFY DIRECTION OF SLOPE, CONDITION OF SLOPE, ETC.

J. OTHER GEOLOGICAL DATA

Continued From Front

XIV. PERMIT INFORMATION

List all applicable permits held by the site and provide the related information.

A. PERMIT TYPE (e.g., RCRA, State, NPDES, etc.)	B. ISSUING AGENCY	C. PERMIT NUMBER	D. DATE ISSUED (mo., day, & yr.)	E. EXPIRATION DATE (mo., day, & yr.)	F. IN COMPLIANCE (mark 'X') 1. YES	2. NO	3. UN-KNOWN
None							

XV. PAST REGULATORY OR ENFORCEMENT ACTIONS

[X] NONE [ ] YES *(summarize in this space)*

NOTE: **Based on the information in Sections III through XV, fill out the Tentative Disposition *(Section II)* information on the first page of this form.**

STORAGE FACILITIES SITE INSPECTION REPORT (Supplemental Report)	INSTRUCTION Answer and Explain as Necessary.

1. STORAGE AREA HAS CONTINUOUS IMPERVIOUS BASE

[ ] YES [X] NO

2. STORAGE AREA HAS A CONFINEMENT STRUCTURE

[ ] YES [X] NO

3. EVIDENCE OF LEAKAGE/OVERFLOW *(If "Yes", document where and how much runoff is overflowing or leaking from containment)*

[X] YES [ ] NO

Small amount seeping into nearby drainage ditch. Monitoring well grossly contaminated

4. ESTIMATE TYPE AND NUMBER OF BARRELS/CONTAINERS

5. GLASS OR PLASTIC STORAGE CONTAINERS USED

[ ] YES [X] NO

6. ESTIMATE NUMBER AND CAPACITY OF STORAGE TANKS

10 tanks, 6 in one group, 4 in another (5000 to 15000 gallon capacity)

7. NOTE LABELING ON CONTAINERS

None

8. EVIDENCE OF LEAKAGE CORROSION OR BULGING OF BARRELS/CONTAINERS/STORAGE TANKS *(If "Yes", document evidence. Describe location and extent of damage. Take PHOTOGRAPHS)*

[ ] YES [X] NO

9. DIRECT VENTING OF STORAGE TANKS

[ ] YES [X] NO

10. CONTAINERS HOLDING INCOMPATIBLE SUBSTANCES *(If "Yes", document evidence. Describe location and identity of hazardous waste. Take PHOTOGRAPHS.)*

[ ] YES [X] NO

11. INCOMPATIBLE SUBSTANCES STORED IN CLOSE PROXIMITY *(If "Yes", document evidence. Describe location and identity of hazardous waste. Take PHOTOGRAPHS.)*

[ ] YES [X] NO

12. ADEQUATE CONTAINER WASHING AND REUSE PRACTICES

[ ] YES [ ] NO UNK

13. ADEQUATE PRACTICES FOR DISPOSAL OF EMPTY STORAGE CONTAINERS

[ ] YES [ ] NO

APPENDIX C

July 18, 1973 letter

from

Charles P. Riley, Jr. of National Polychemicals

to

Thomas C. McMahon of Massachusetts Water Resources Commission

STEPAN National Polychemicals Division

Eames St., Wilmington, Massachusetts

July 18, 1973.

RECEIVED

JUL 26 1973

MASS. DIVISION OF
WATER POLLUTION CONTROL

Mr. Thomas C. McMahon, Director
The Commonwealth of Massachusetts
Water Resources Commission
Leverett Saltonstall Building
Government Center
100 Cambridge Street
Boston, Massachusetts 02202.

Dear Mr. McMahon:

The following is an item by item response to your letter of July 13, 1973.

(1) The large volume of "industrial sludge" is pure calcium sulfate (gypsum) which had been lifted out of the secondary clarifier. This material has no odor and has not been eroded since being placed in its present position. It became necessary to remove this material from the pond because overflow conditions were being reached as the pond had filled at a much faster rate than had been anticipated due to a lower rate of compaction as the solids level increased. I am sure that your Division is aware of the fact that Dana Perkins has been engaged to engineer a second secondary clarifying pond and also a sanitary landfill for the gypsum on our property adjacent to the Woburn City dump. The engineering work on both of these projects has been progressing and Mr. Tarbell of Public Health and Mr. Romano, Wilmington Health Officer, have made a preliminary inspection of the proposed landfill area and of the secondary clarifier. It was pointed out at this time that erosion had not taken place even with very heavy rains. The general plans as developed by our consultant, Dana Perkins, entail the use of two secondary clarifier ponds with one area cleaned each year by removal of the gypsum to the approved landfill area. These plans will be submitted to your Division for review as soon as preliminary approval is obtained from Public Health.

(2) The PVC liner in the lagoon has not been broken in two places. I can only assume that this comment refers to several channels from the lagoon that were created by the pond overflowing for a short period before the calcium sulfate was removed.

(3) The wells referred to were experimental borings, placed under pumping tests by the D. L. Maher Company of North Reading. We were assured by Mr. Maher that he had the right to conduct flow tests on these wells without obtaining permits. This flow was discontinued on February 5, 1973 and will not be restarted.

(4) The oil drums that receive the flow from the skimmer have been removed, the area cleaned and tight housekeeping will be maintained in the future.

The oil seepage which was directed to our attention by your inspectors was at the railroad ditch level about 10 - 15 feet below grade and behind our chemical storage tank farm. All tanks and lines were examined and found to be free from leakage. The soil behind the tankfarm at grade level is sandy and clean with no indications of chemical runoff. Our water pollution consultants from the Badger Corporation examined this site and have theorized that the seepage could be due to natural occuring hydrocarbons being leached from the soil at the extremely high water table that was experienced in May of this year.

We have recently examined the railroad ditch under the prevaling conditions of a much lower water table and there are now only very slight traces of oil films in the ditch. I am sure that your Division is aware that this ditch is loaded with raw sewerage emanating from above our plant site and that the bottom of the ditch exhibits concentrations of black sludge which appears to be raw sewerage derived.

At the present time, we are cooperating very closely with the Town of Wilmington, the MDC, and Public Health to eliminate all of our problem areas through approved long-term solutions. The Badger Corporation are consulting with us on the mechanics of the treatment plant with particular concentration in the area of finding more efficient sump pumps to handle our effluent streams. We have attempted to cooperate fully with your Division as evidenced by our conducting engineering personnel from other companies through our facility at Mr. Bonne's request and offering our engineering designs free of charge. However, on the inspection level, we feel that cooperation has been less than desirable. During the last inspection, your people refused my invitation to enter the office building and discuss with me their findings. They indicated to the plant people that they were "too busy" to do this. On another occasion one of your inspectors drove an automobile directly into our plant and through several hazardous operating areas to the treatment plant. I am sure that you are aware under the OSHA regulations that we are responsible for the safety of all persons who enter our plant areas and that all visitors must be equipped with the proper safety equipment at the front office.

The key personnel in this Division are ready to discuss our entire program and the individual points raised in your letter of July 13 at any time convenient to your personnel.

Very truly yours,

NATIONAL POLYCHEMICALS
A Division of Stepan Chemical Company

Charles P. Riley Jr

Charles P. Riley, Jr.
General Manager

CPR/jlp

Pg 3-2 missing

PHASE I

SITE INSPECTION REPORT

For The

OLIN CHEMICAL GROUP

Wilmington, Massachusetts, Middlesex County

SEPTEMBER 1986

DRAFT

OCT 2 1986

OCT 2 1986

DEQE • MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING

MASSACHUSETTS

FIELD INVESTIGATION TEAM

WEHRAN ENGINEERING CORP.
Engineers & Scientists
Methuen, MA 01844

MASSACHUSETTS FIT CONTRACT
PHASE I SITE INSPECTION REPORT
OLIN CHEMICAL GROUP
WILMINGTON, MASSACHUSETTS, MIDDLESEX COUNTY

DEQE Project Number 86-01-086-093

WE Project Number 50086.10

September 1986

DRAFT

WEHRAN Task Manager	David B. Tompkins
DEQE Task Manager	Harish Panchal

Approvals

WEHRAN	Kevin M. Burger, Project Manager	____________________
DEQE	Richard Bates, Contract Administrator	____________________

TABLE OF CONTENTS

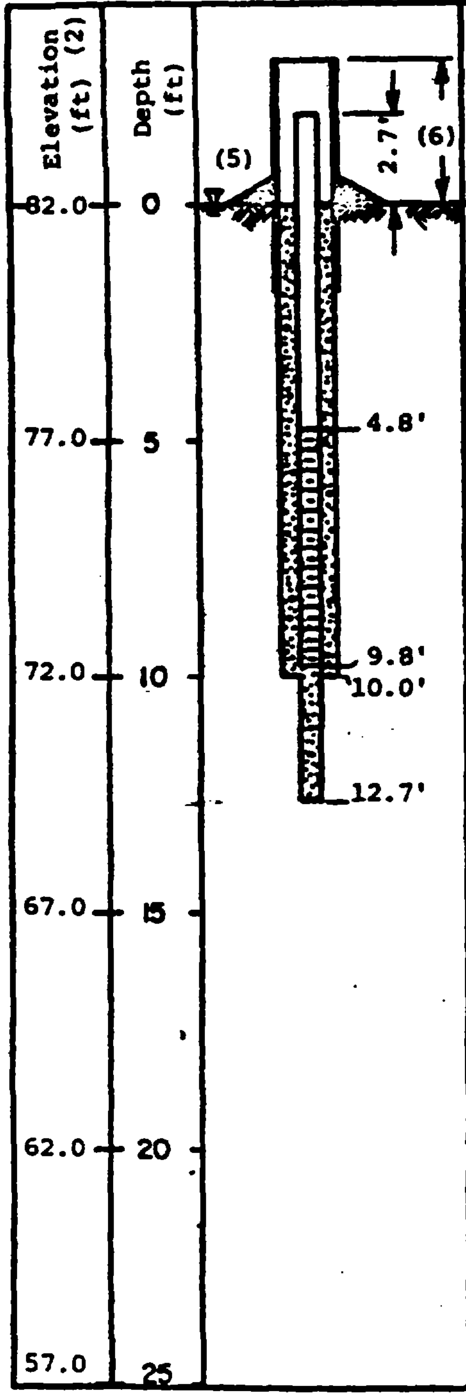
DRAFT

GROUNDWATER WELL INSTALLATION REPORT

Groundwater Well No.: 12 | Date Installed: Nov. 2, 1977

Permeability (1) : 4×10^{-3} cm/sec | Project No. : 77348

Well Installed by Carr-Dee Test Boring Corp. | Soils Described by R. Gardner, GEI



Split Spoon Sample No. and Location	Blows per 6" (3)	Rec. (in.) (4)	Sample Description
SS-1A SS-1B	1-1-2-3	17	SS-1A ~8" Black sandy humus SS-1B ~9" Brown organic silty fine sand.
SS-2	19-30-40-34	13	SS-2 Light brown slightly silty, gravelly fine to coarse sand.
SS-3	33-34-29-21	9	SS-3 Gray slightly silty sandy gravel. Gravel is angular to subrounded and up to ~1 3/8" in size.
*			*Drove open-ended "A" rod with 200-lb weight. 120 blows for last 2" of penetration. Recovered brownish-gray clayey, gravelly sand.

Notes: (1), (2), (3), (4) See first page of Appendix A for additional information.

(5) Groundwater level is the average of seven measurements taken from November 2, 1978 to May 31, 1978.

(6) Prior to May 31, 1978, distance from ground surface to top of casing was 3.3'. Casing was removed to perform permeability test and replaced to present "stickup" of 3.6'.

Geotechnical Engineers Inc.

1.0 BRIEF SITE DESCRIPTION

1.0 BRIEF SITE DESCRIPTION

The Olin Chemical Corporation, Wilmington facility is located at 51 Eames Street, Wilmington, Massachusetts. The facility which formerly was owned by Stephan Chemical Company and National Polychemical, respectively, manufactures chemical blowing agents, stabilizers, antioxidants, and other specialty chemicals for the rubber and plastics industry. The site has been the location of a chemical manufacturing facility since 1953 with several hydrogeologic and environmental studies conducted since 1977.

Waste disposal practices, past and present, have resulted in apparent contamination of groundwater supplies within the vicinity of the site. Past disposal practices included the dumping of waste into open pits and ditches located throughout the site. These methods were modified in the early to mid 1970s by Stephan Chemical Corporation.

More recent waste management techniques instituted by Olin Chemical have included Hypalon lined lagoons, landfilling of sludge, an interceptor well system, and RCRA tank/drum storage areas. However, file documents contain reports of leaking PVC liners, unlined drum storage pads and overflowing conditions at the lagoons during the years of ownership by Stephan Chemical.

Review of the existing hydrogeologic investigations indicate that contamination of groundwater has occurred due to potential leakage from the lagoons and remnant effects of the former acid pits. Primary suspect causes of surface water contamination are leakage from the tank/drum storage areas and contaminated groundwater discharge to the surface water route.

Olin Corporation submitted its closure plans for its Wilmington plant's RCRA facilities on April 14, 1986 to the MDEQE and the USEPA. Olin ceased chemical production at the Wilmington facility on July 1, 1986 and product blending processes on or about September 1, 1986.

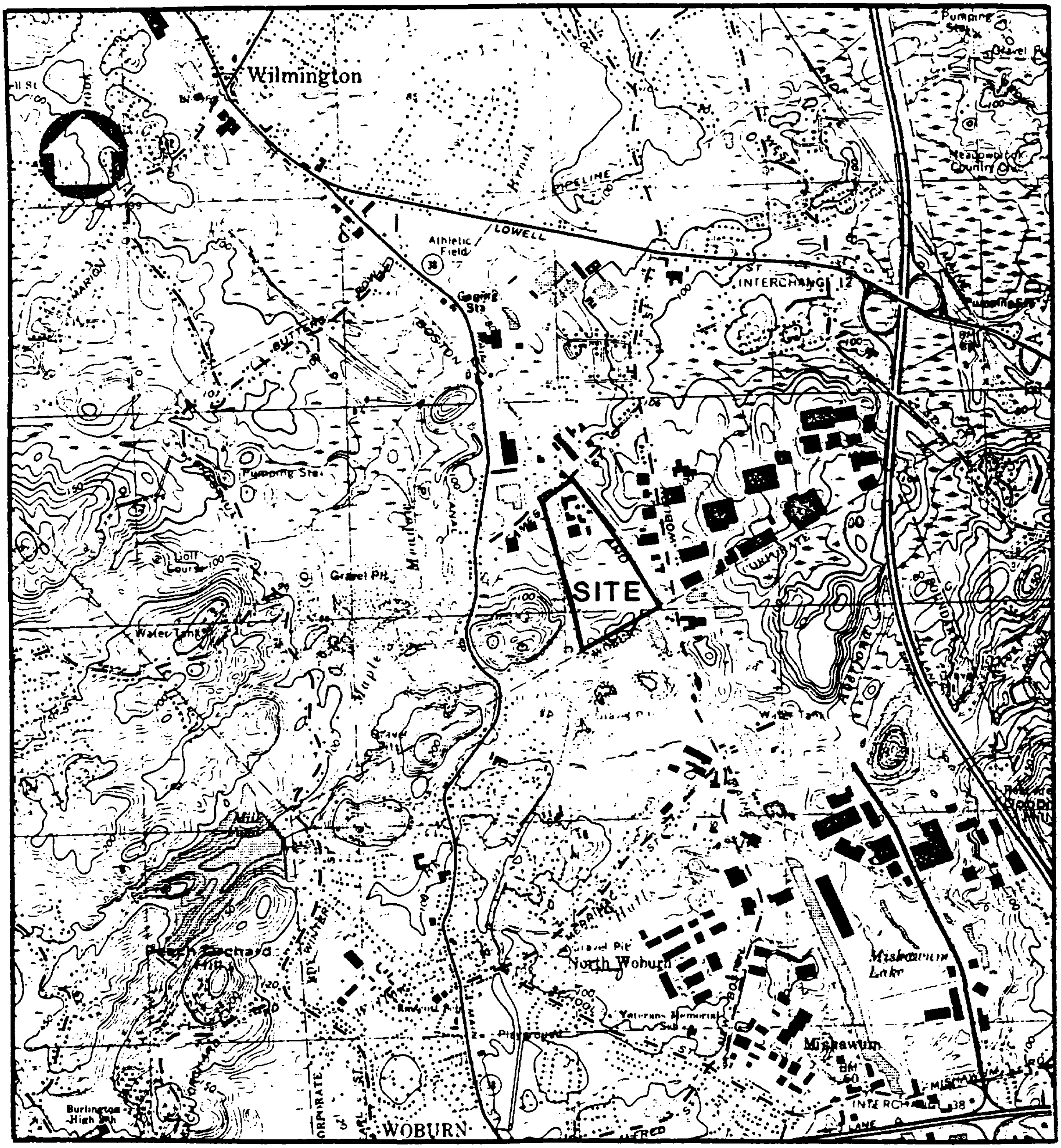
Information gathered during the current PA/SI investigation has resulted in the calculation of a Hazard Ranking System migration score (S_m) of 42.49. Recommendations for further action include additional environmental monitoring, expansion of the study area to possibly include local private wells, and development of remedial measures to control or remove residual contamination.

2.0 SITE LOCATION

2.0 SITE LOCATION

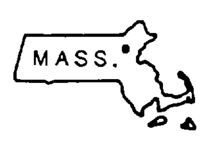
Figure 1 presents the USGS 7.5 minute Topographic Map for the Wilmington, Massachusetts quadrangle which identifies the site location. The geographic coordinates of its site are approximately 42° 30' 48" north latitude and 71° 09' 10" west longitude.

DRAFT



SCALE: 1" = 2083'

TOPOGRAPHY TAKEN FROM 1965
WILMINGTON, MASS.
(PHOTOREVISED 1979)
U.S.G.S. QUADRANGLE
7.5 MIN. SERIES



MASS FIT
MAP LOCATION

FIGURE 1

SITE LOCATION MAP

OLIN CHEMICAL GROUP

3.0 SITE HISTORY

1955
1986) 31 years

3.0 SITE HISTORY

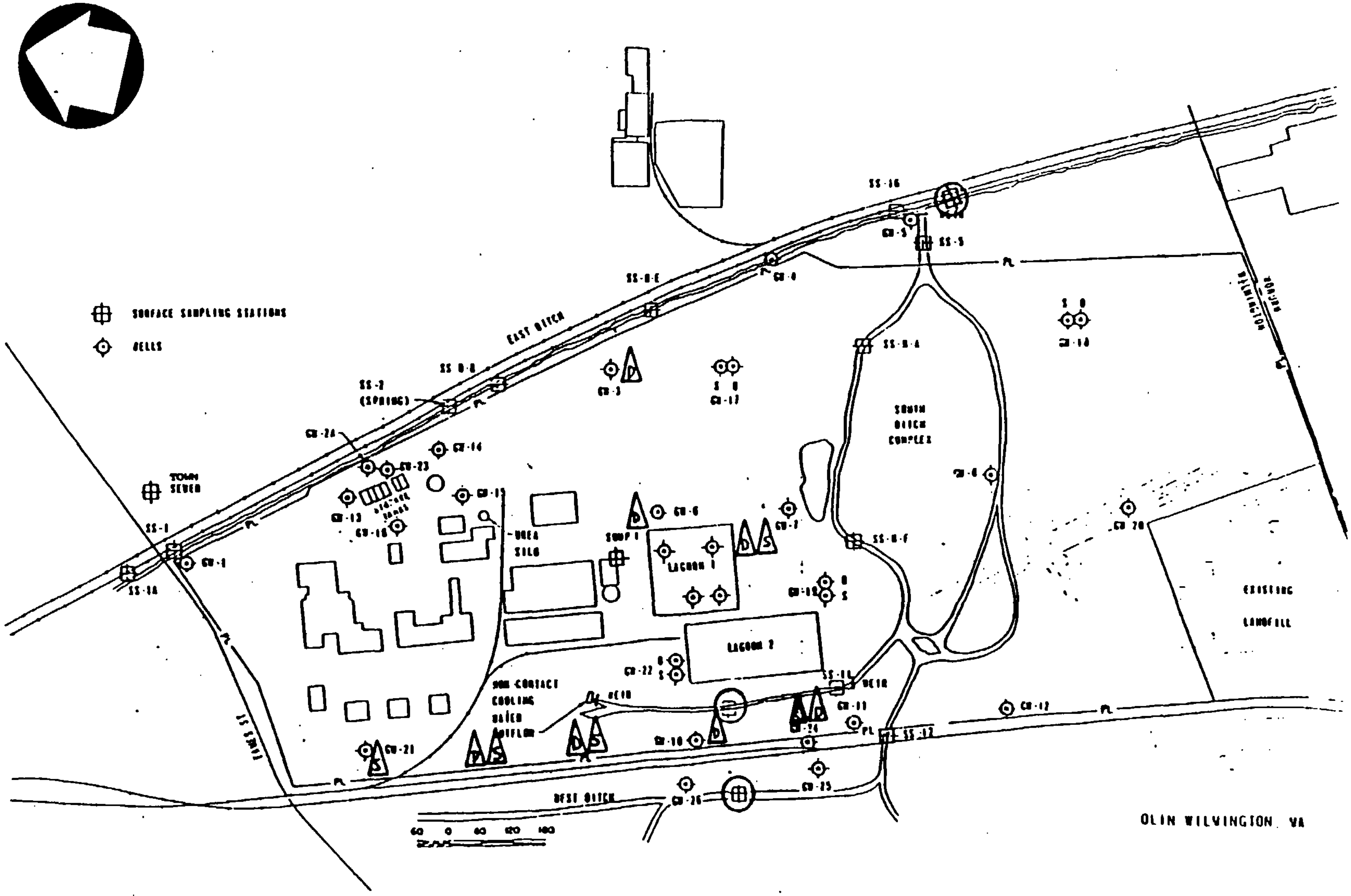
Chemical plant operations began at the 51 Eames Street site in 1953 under the ownership of National Polychemicals, Inc. In 1971, National Polychemical merged with Stephan Chemical Company whose operation was in-place until 1979. The property was later purchased by Olin Chemical Group in September 1980 from Stephan Chemical. Olin Chemical initiated closure activities in 1986 at the 51 Eames Street site.

Primary site activity during the years of operation included the synthesis of various compounds used as blowing agents, antioxidants, stabilizers, resinous solids, and numerous coatings for rubber and plastics products. Reference 4 contains lists of raw materials and waste products associated with chemical processes used by National Polychemicals, Inc. and Stephan Chemical Company between [illegible] and 1978.

In 1969, National Polychemicals began a waste segregation and abatement program in order [illegible] abatement of pollution in the Abjerona River and prepare for pretreatment of all process waste prior to discharge to the Metropolitan District Commission (MDC) sewer line. The connection to the MDC sewer line was not completed during ownership by National Polychemical. As a result of the installation of closed cooling water systems, a 90 percent reduction of aqueous wastes was achieved. All other wastes were discharged on site.

National Polychemical utilized three sewer systems at the site for waste disposal. These systems included the following:

- Sanitary Sewer System - Transported domestic wastes from various buildings to septic tanks for removal of gross solids. Effluent from septic tanks was allowed to leach into the ground via conventional tile field systems. This system is currently still in use.
- Process Sewer System - Contained an epoxy four to six-inch pipe system to transport concentrated acid wastes from Plants C-1, C-3, and Building 17 into the acid pit southeast of the plant.



△ NEW PLANNED WELLS (INSTALLED 1986)

⊕ ADDITIONAL SURFACE STATIONS

SOURCE: 1982 MALCOLM PIRNIE

FIGURE 2

SITE SKETCH

OLIN CHEMICAL GROUP

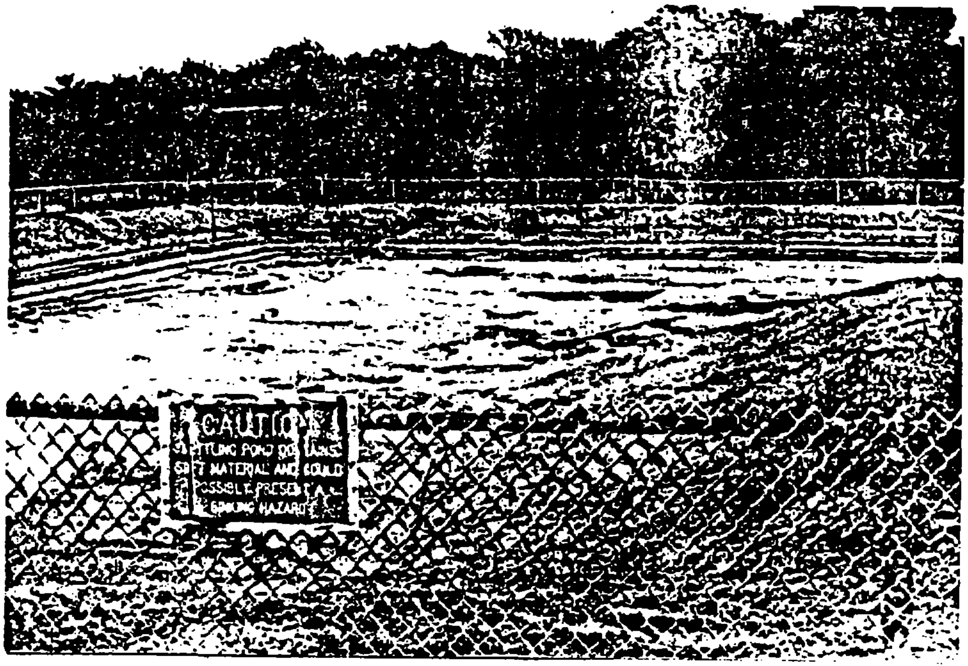
NTS

constructed in 1972 and 1973, respectively (Figure 3). The amount of calcium hydroxide slurry added to effluent containing sulfate was such that the resulting sludge may have a pH as high as 11. The lower limit of pH for material pumped into the lagoons is unknown.

Sludge remained in the lagoons until it had air dried sufficiently to be removed. Periodically (on the order of once every one or two years) the "dried" sludge was removed from the lagoons and placed in a landfill area in the southwest corner of the site (Figure 4). According to Stephan personnel, sludge was removed from the lagoons with a clamshell bucket loader and put into trucks for transport to the landfill. Stephan personnel noted on several occasions that sludge in the lower portion of the lagoons remains in a wet state and that the clamshell could not lift this wet material because of its tendency to flow out of the clamshell bucket. Excessive wetness of the sludge may have been due to insufficient evaporation or that groundwater was in hydraulic contact with the sludge due to faulty liners. **Presently, no data or information indicating that the sludge landfill is impacting environmental conditions is available.**

Upon purchase of the facility, Olin Chemical instituted many changes at the site. Modifications/remedial measures instituted by Olin Chemical at the Wilmington facility have included the following actions:

- Quarterly sampling and monitoring of 16 existing groundwater wells on site. Additionally, 20 other groundwater monitoring wells were installed from 1983 to 1986. Presently, the monitoring program is continuing.
- Cleanout and repair of Lagoon 2. Lagoon was dewatered in May 1982 allowed to dry to facilitate handling of the sludge. Replacement of the liner occurred about June-July 1983. Lagoon 1 was cleaned and repaired in 1981. Liners used were 36-mil Hypalon covered by one foot of compacted sandy/clay material.
- An interceptor well system instituted in April 1982 (Figure 5). Groundwater was pumped from the ground in the vicinity of the



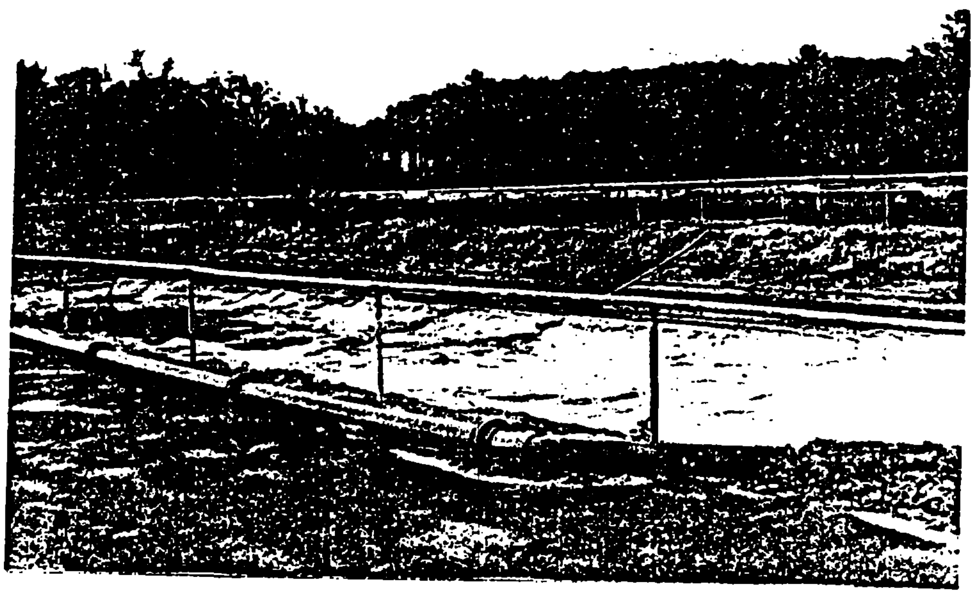


FIGURE 3

Sludge Storage Lagoons

Located in center of site
Presently being emptied for closure

FIGURE 4

Sludge Landfill

Southwest corner of site

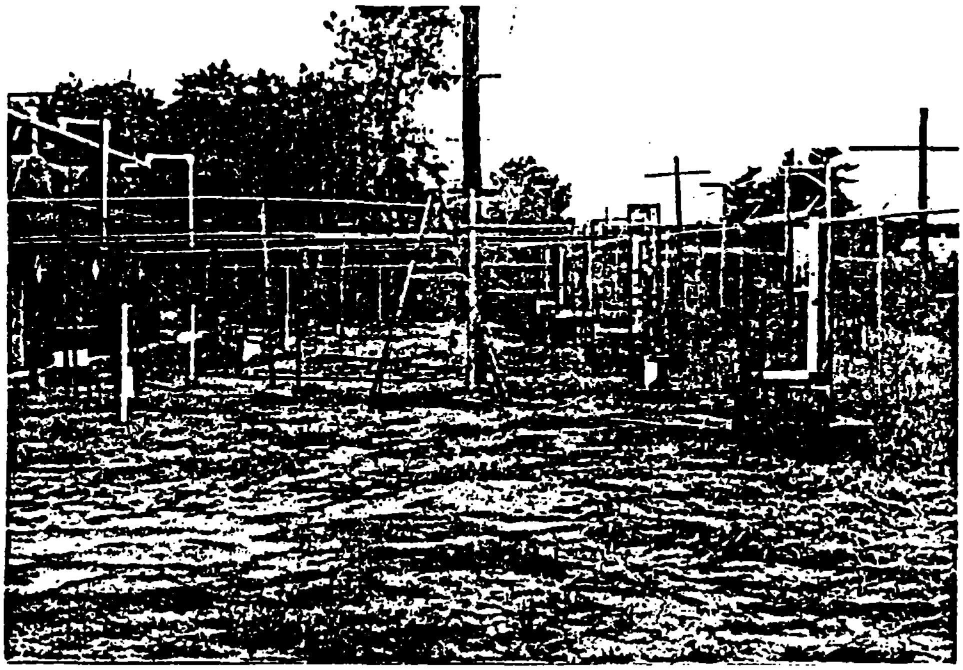


FIGURE 5

Groundwater Interceptor System

Northeast corner of site adjacent
to east ditch and tank farm 1

east ditch and utilized as non-contact cooling water. Discharge of cooling water occurred to the MDC sewer lines. This remedial action is still in place at the site.

- Contaminated soil (20 cu. yd.) along the east ditch which reportedly resulted from disposal/storage practices associated with Stephan Chemical were removed in November-December 1982. Contaminated soil was removed for disposal at SCA, Inc. Hazardous Landfill in Model City, New York. The excavated soil was replaced with clean stone and fill.
- Olin has conducted extensive work on both the non-sulfate and sulfate in-plant sewer lines. Actions included cleaning and replacement of sewer lines and manholes.

Since purchasing the site in 1980, Olin Corporation has exceeded $5 million in expenditures on improvements for the Wilmington facility. Expenditures have primarily been for remediation of problems inherited with the plant and associated with prior waste disposal techniques.

Due to foreign market competition and a business decision to consolidate its production lines, Olin Chemical initiated closure activities at the Wilmington plant. Olin Corporation submitted its closure plans for its RCRA facilities on April 14, 1986 to the MDEQE and the USEPA. Olin ceased chemical production operation at the Wilmington facility on July 1, 1986 and product blending processes on or about September 1, 1986.

4.0 SITE INFORMATION

4.0 SITE INFORMATION

4.1 TOPOGRAPHY

The Olin Chemical site is located at 51 Eames Street, Middlesex County, Wilmington, Massachusetts. The site is approximately 50 acres and is bounded on the north by Eames Street, on the east and west by Boston and Maine railroad tracks, and to the south by the Wilmington/Woburn Town line.

The manufacturing buildings are located in the northern section of the site along Eames Street while the southern section remains forested. Two sludge lagoons are located in the central area of tlf site. A sludge landfill area is located in the southwest corner of the site.

Land use is in the vicinity fo the site is predominately commercial with private homes located 0.5 miles to the northeast and southwest of the site. Surrounding businesses include light industries, warehouses, distribution centers, a concrete manufacturing plant, and a chemical facility.

Located within the central portion of the site is an estimated 12 to 15-acre wetland area (Figure [illegible]). This wetland area includes both palustrine emergent and palustrine forested areas. Other wetland areas are located within one mile to the east and west.

Elevation at the site ranges from approximately 70 to 100 feet MSL. Topographic highs are located in the northern and southern sections of the site resulting in slopes estimated at 5 to 10 percent towards the on-site wetland.

Located south of the site, adjacent to the sludge landfill is the Town of Woburn's Municipal Landfill. Drainage from the Woburn's landfill may be entering onto Olin property.

4.2 SURFACE WATER

There are no major surface water streams located on the site. A series of drainage ditches apparently routes the flow of surface water away from the manufacturing buildings. These ditches parallel approximately north-south along the east and west boundaries. A third ditch bisects the center of the site in an east-west direction.

FIGURE 6

Wetland Area - Center of Site

South of sludge lagoons

The Massachusetts Division of Water Pollution Control has established that the east drainage ditch (Figure 2) is a Class B waterway suitable for the propagation of fish and for primary and secondary contact recreation. It should be noted that the east ditch is adjacent to Boston and Maine railroad tracks and during the Wehran site inspection exhibited a very murky, rust-colored appearance.

Within the Olin property boundaries, the three drainage ditches merge into the east ditch. Surface water is transported approximately 0.9 miles downgradient of the site (south-southeast) to Hall's Brook. Hall's Brook flows 0.2 miles before merging with the Aberjona River. The Aberjona River empties into Mystic Lake approximately 5.7 miles downstream of its confluence with Hall's Brook. These water systems are located within the Mystic River Basin and are all Class B waters. Surface water quality standards for these surface waters are presented in 314 CMR4.

4.3 HYDROGEOLOGY

The hydrogeology of the area surrounding the Olin Chemical site is described by Malcolm Pirnie (1982) and Geotechnical Engineering (1978). These reports are included in Appendix A, References 2 and 3, respectively. Generally, bedrock underlying the site consists of gneissic rock with quartz-filled fractures. Depth to bedrock varies from 0-23 feet below the ground surface. Outcrops with steeply dipping fracture planes are located in the northwest and southwest corners of the site and along the eastern drainage ditch. A bedrock valley which dips to the west is reported as occurring in the central portion of the site in the vicinity of the present day lagoons.

Unconsolidated deposits at the site consist of till and outwash. Till consisting of unstratified, poorly sorted sands, silt, gravel with occasional cobbles and boulders overlies the bedrock. Outwash materials composed of graded sands and silts with traces of clay and gravel overlies the till. An organic surface layer was encountered near the low lying swampy area.

Well logs from monitoring wells indicate groundwater levels at zero to nine feet below the ground surface. A natural groundwater gradient towards the south-southeast is reported in the unconsolidated deposits. However, variation may exist due to the bedrock configuration and the location of on-site recharge areas.

Malcolm Pirnie (1982) reports a north-south trending groundwater mound is superimposed on this natural gradient in the area which underlies Lagoon 1 and the buildings to the north of Lagoon 1. This mound is probably influenced by man-made inputs. Leakage from the lagoons probably contribute to the south end of the mound. Groundwater recharge by roof or foundation drains from the buildings and possibly leakage from sewer lines also represent a minor contribution.

Presently, insufficient data are available to assess the probability of a hydraulic connection between the unconsolidated deposits and the gneiss bedrock. Thirty-six monitoring wells have been installed at the site and accurately descibe the unconsolidated deposits, but due to their shallow depth, these wells do not penetrate bedrock and do not identify a confining layer above the rock to restrict downward vertical migration of contaminants. Downward vertical contaminant migration is suggested by the Malcolm Pirnie data for ammonia, chlorides, and sulfates in nested wells. For the purpose of calculating an HRS score, a hydraulic connection between the bedrock and unconsolidated deposits will be assumed to exist and all contaminant wells identified in the area within a three-mile radius will be included for deriving a preliminary HRS score.

4.4 WATER SUPPLIES

Most residents within the Towns of Wilmington and the adjacent Towns of Woburn, Burlington, and Reading, rely on municipal water systems for domestic water needs. These municipal systems currently obtain water from groundwater reserves. Municipal water distribution maps for Woburn, Burlington, and Reading have been obtained and included in the site file. Wilmington presently does not have a distribution map.

In the area just southwest of the site, approximately 20 homes are located along Main Street near the Wilmington/Woburn town line. Information obtained from Mr. Paul Duggan, Town of Wilmington, Water Superintendant, indicates that these homes are not serviced by municipal water. Domestic water supplies for these homes are obtained from private groundwater wells. Contacts with the water and health department revealed that there is no documentation of these wells and no indication as to which aquifer they are located in (Appendix A, Reference 14).

Mr. Duggan has also provided information indicating that two groundwater wells are located at the Wilmington water treatment facility located 4,000 feet northwest of the site. Two pumping stations are located to the south and east of the water treatment plant and supply raw water to the municipal system also. Approximately 17,000+ people are served by the Wilmington municipal system.

To the south of the site in the Town of Woburn, two municipal wells are located within three miles. These wells were recently removed from the Woburn municipal system due to their involvement in the W.R. Grace-Leukemia case.

Information on the location and usage of private wells in the vicinity of the site is insufficient to fully assess potential impact concerning human health. Reading Health Department has obtained a list of addresses with private wells. Unfortunately, this information could not be obtained prior to printing of the PA/SI report. Woburn and Burlington Engineering and Health Department have no information on private wells.

4.5 PAST SAMPLING AND ANALYSIS

Previous investigations at the Olin Chemical Wilmington facility have included three subsurface investigations to define on-site hydrogeology (Malcolm Pirnie 1982, New England Pollution Control Company 1980, Geotechnical Engineering, Inc. 1978), and one investigation to determine compliance with RCRA and/or the 311/104 Clean Water Act (Ecology and Environment 1980).

Under authorization from the Massachusetts Water Resources Commission, Division of Water Pollution Control (DWPC) (Contract No. 9708-11-100-5-77-CR), Geotechnical Engineers, Inc. (GEI) conducted 12 soil and rock borings on the Stephan Chemical property (see Appendix A, Reference 3). Groundwater wells were installed in 11 of these borings to obtain groundwater levels and water samples. During the period of 1977 to

1978, GEI collected 58 groundwater and 57 surface water samples from the site. These samples were subject to inorganic analysis only.

A summary of the GEI analytical data indicated a zone of high chemical concentrations in the vicinity of the lagoons. GEI attributes the contravention of groundwater quality to leakage from the lagoons or remnant effects from the former acid pits. Groundwater data from the GEI study are presented in Appendix A, Reference 3.

GEI reports surface water contamination due to groundwater discharge in the vicinity of the east ditch. Inorganic contamination becomes more apparent as the surface water flows north to south along the eastern ditch. However, the pH concentration remains unchanged or becomes slightly more neutral.

In 1980, New England Pollution Control Company, Inc. (NEPCO) was requested by Olin to investigate the area on the eastern boundary of the site where black material was discharging out of the east bank. Eleven soil borings were made and five observation wells were installed. Samples of the black material were analyzed and groundwater measurements were made to determine direction of flow. Copies of the NEPCO data have not been included in this report.

Also during 1980, Ecology and Environment, Inc., under authorization from the USEPA Region I, Office of Uncontrolled Waste Sites, conducted a site investigation to determine the potential environmental contamination (Appendix A, Reference 4). Surface water sampling was performed by the USEPA on January 23, 1980 on surface water in the east drainage ditch. Results of these samples indicate that moderate to high levels of 1,1-diochloroethane, 1,1,1-trichloroethane, trichloroethylene, toluene, and xylene are present in surface water upstream of the site. In addition to the above compounds, 1,1,2-dichlorethylene and 1,1,2-trichloroethane were detected downstream of the Stephan/Olin site.

Analytical results from the groundwater analyses have not been obtained. However, the presence of a black seep in the vicinity of the east ditch is confirmed. Ecology and Environment, Inc. documents presence of this seep and confirms the existance of the phthalate, diphenolamine, dioctylamine, and other organics in the seep material.

Malcolm Pirnie, Inc., under contract with Olin Corporation, investigated site conditions in 1982 at Olin's Wilmington Plant. Ten new monitoring wells were installed at the site to bring the total to 26 monitoring wells. The number of samples obtained were groundwater (30), surface water (14), sewers (3), and lagoons (3). A summary of Malcolm Pirnie's conclusions from the hydrogeologic and inorganic data are as follows:

- Surface water flow is controlled by the three ditches.
- Groundwater hydrology is governed by the topography and bedrock configuration. The regional groundwater flow is towards the southeast and occurs mainly in the unconsolidated material.
- A water budget analyses and subsequent physical inspection was used to determine that sludge Lagoon 1 was leaking. (Lagoon 2 was not analyzed but actions were initiated to replace both liners).
- Specific conductance values were reported high in the areas surrounding the lagoons near the northeast storage tanks, and near the west ditch. The two source areas for dissolved species appeared to be the areas surrounding the lagoons and the storage tanks.
- Remnants from the former acid pits in the vicinity of the lagoons appear to be the source for H+ ions, ammonia nitrates, chlorides, sulfates, chrome, cadmium, and lead.

Organic analysis of Malcolm Pirnie's groundwater samples indicate that there appears to be two minor areas of volatiles in the groundwater. The first area is around the northeast storage tanks, where mid to upper range concentrations (0.05 to 0.20 mg/l) of toluene were found in Wells GW-2+2A and GW-16 (Figure 2).

The second area of high concentration (greater than 0.20 mg/l) is around the lagoons and the nearby plant area. Moderate to high concentrations of bromoform, 1,2-dichloroethane, and toluene appear in Wells GW-6, GW-7, and GW-19D which surround the lagoon area. As discussed earlier, Lagoon 1 was believed to have had a ruptured liner during this study. This condition would have allowed infiltration of liquid into the groundwater.

Surface water samples analyzed for organic volatiles detected no apparent on-site contamination. However, contamination appeared to be entering the east ditch from off site (north) sources.

Additionally, base/neutral compounds were also detected in elevated concentrations in groundwater samples. These included bis(2-ethylhexyl)-phthalate, butyl benzyl phthalate, di-n-butyl phthalate, N-nitrosodiphenyl-amine, and dioctyldiphenylamine.

There appears to be two source areas of B/Ns on site. The first is around the northeast storage tanks. This source appears to be very localized and is probably due to past activities in the area around the tanks. The second area appears to be around the lagoons. This source area is much more generalized, and is evidenced by mid to upper range concentrations.

Bis(2-ethylhexyl) phthalate occurs in upper range concentrations (greater than 0.20 mg/l) in both areas, with the highest concentrations occurring near the storage tanks.

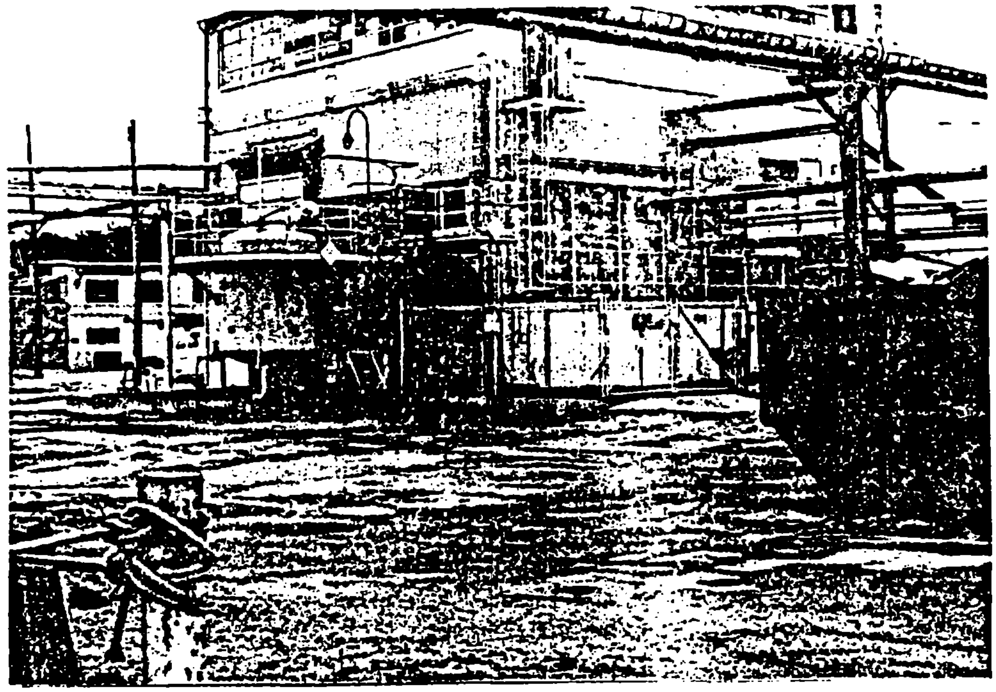
N-nitrosodiphenylamine and dioctyldiphenylamine are distributed around the source areas in a similar fashion to bis(2-ethylhexyl)phthalate, but they are less widespread over the site. Butyl benzyl phthalate and di-n-butyl phthalate occurred in low to moderate concentrations (0.05 to 0.20 mg/l) around the two source areas.

Base/neutral compounds detected in surface water samples were bis(2-ethylhexyl)phthalate, N-nitrosodiphenylamine and dioctyldiphenyl-amine. Monitoring of the surface water at the Olin site indicates that discharge of base/neutrals into the surface water occurs primarily on the eastern side of the site. Base neutrals do not appear to be coming in from off-site to the north as was the case with the volatiles. Sources of contamination appear to be both leakage from the NE storage tanks and from groundwater discharge.

Surface and groundwater samples obtained during semi-annual monitoring activities at the Olin Chemical site have mostly been targeted at analysis of inorganic parameters. These data suggest the source area for contamination by chrome (Cr^{+6} and Cr^{+3}), sulfate, chlorides, nitrates, and specific conductance is the area surrounding the sludge lagoons (former pit area).

Remedial actions designed to mitigate the above-referenced contamination have included replacement of damaged lagoon liners, lined drum storage areas (Figure 7), groundwater interceptor wells, removal of contaminated soil along the east ditch and replacement/updating of sewer lines. Continuing quarterly monitoring has continued at the site with similar patterns of contamination as outlined by Malcolm Pirnie.

In summer of 1986, 10 new groundwater monitoring wells were installed along the west site boundary to explore the effect of the bedrock trough on the site-specific groundwater flow. Sampling data from the wells are not yet available.



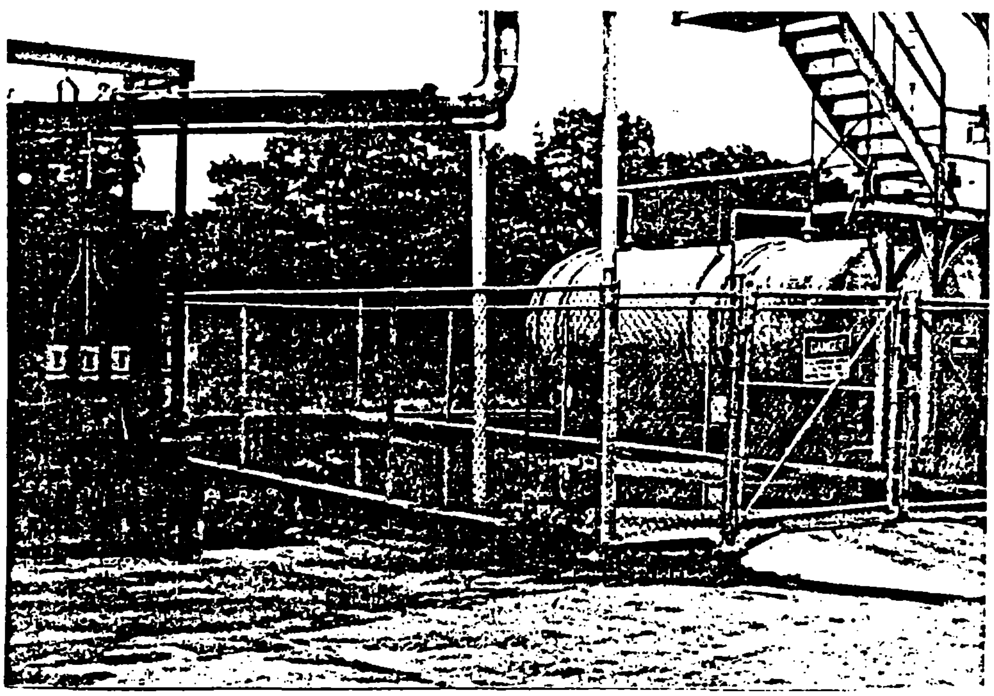


FIGURE 7

Drum Storage Areas

Center of site - waste previously removed

5.0 PATHWAYS AND RECEPTORS

5.0 PATHWAYS AND RECEPTORS

Past disposal practices at the Olin Chemical facility have resulted in groundwater contamination in the vicinity of the site (Malcolm Pirnie 1982, Ecology and Environment 1980, GEI 1978). Presently, vertical contaminant migration remains largely undefined, while horizontal migration and subsequent discharge into the drainage ditches located at the site has been well documented.

Both Malcolm Pirnie (1982) and Geotechnical Engineers, Inc. (1978) have documented groundwater discharge to the drainage ditch complex located on the site. In the vicinity of the east ditch, the groundwater interceptor wells should be providing sound mitigative measures to alleviate detrimental discharges to the surface water. However, this can only be verified by continued monitoring. Groundwater discharges to the south and west ditches are currently incorporated into the wetland flow which exits the site via the surface water pathways. The surface water is not used for a drinking water supply within one mile of the site.

Potential receptors of groundwater contamination include the private homes located southwest of the site, the Wilmington municipal well located west of the site and the private wells located within the Towns of Woburn and Reading. Because the previous hydrogeologic investigations have suggested that the contaminants in groundwater at the Olin site are largely flushed into the surface drainage paths exiting the site, the potential for a wide area of contaminated drinking water attributable solely to the Olin site is not apparent. However, there is insufficient information available on deep aquifer quality and no data on site specific bedrock aquifer characteristics to establish boundaries on the zone of potential groundwater contamination.

6.0 ASSESSMENT OF DATA

6.0 ASSESSMENT OF DATA

On September 16, 1986, a site inspection was performed by Wehran Engineers and Scientists to evaluate the need for further action at the Olin Chemical site. Information obtained during the site inspection was combined with file information to obtain an HRS score of $S_m = 42.49$, $S_{FE} = 0$, $S_{DC} = 0.00$.

6.1 GROUNDWATER ROUTE

A groundwater route score of $S_{gw} = 73.08$ was calculated for the Olin Chemical site. Scoring is based primarily on two factors: 1) the presence/documentation of contamination in the groundwater which has resulted from improper waste disposal practices by the former site owners, and 2) the exclusive reliance of local residents on groundwater wells (both municipal and private).

Groundwater movement is anticipated to be towards the southeast in the vicinity of the site. However, the effect of the bedrock trough, located near the lagoon, on the groundwater directional flow is unknown. Data from the new wells installed by Olin during summer 1986 should alleviate this deficiency.

The impact of groundwater contamination on the private and municipal wells located near the site is unknown. A survey of selected private wells, especially those located immediately southeast of the site in the Town of Worburn is recommended to determine what aquifer is in use by neighboring residents.

6.2 SURFACE WATER ROUTE

The HRS route score for surface water (S_{sw}) was 7.97. Low scoring is due to the undefined use of surface water downstream of the site. Presently, no significant use and/or impacted population has been identified.

Although a release to the surface water route has been scored, the impact on the surrounding environment is not believed to be extensive. Dilution of surface water combined with the buffering effect of the adjacent wetland may have provided some environmental protection to the surface water route.

6.3 AIR ROUTE

No measurable readings of organic vapors were detected with the HNU Photoionizer during the site inspection, resulting in an air route score of zero. Additional air monitoring should be performed during any subsurface investigation to check for possible contamination resulting from disturbance of the ground by subsurface drilling and also as a standard safety measure for personnel involved in the investigation.

No true assessment of possible air exposure

6.4 FIRE AND EXPLOSION

To score the fire and explosion hazard mode either a state or local fire marshall must have certified that the facility presents a significant fire or explosion threat to the public or to a sensitive environment, or there must be a demonstrated threat based on field observations (e.g. combustible gas indicator readings). The available records give no indication that either one of these actions has been taken. Further, the available data do not suggest any imminent threat of fire and explosion at this site. Therefore the route score cannot be completed.

6.5 DIRECT CONTACT

Controls to access at the site include perimeter fencing which surrounds the entire site and restricted vehicle access by manned security gates. Drum storage areas and lagoon disposal areas are also fenced within the site. Presently, no documentation of direct contact incidents due to waste disposal practices have been obtained. The Olin Chemical site does not appear to present any evironmental or human health threat due to direct contact. The direct contact score (S_{DC}) is 0.00.

7.0 SUMMARY AND CONCLUSIONS

7.0 SUMMARY AND CONCLUSIONS

It is apparent from the existing data that groundwater and surface water in the vicinity of the site has been impacted by waste disposal practices prior to ownership by Olin Chemical group. Source points for contamination are located in the vicinity of the sludge lagoons and the tank farms along the east bank.

Olin Chemical has conducted several projects at the site which have been targeted at site investigation and remediation. These projects should continue and should also be incorporated into the strategies being developed for closure of the Wilmington facility.

It is recommended that additional remediation plans/alternatives be incorporated into the development of a Closure Plan. Quarterly monitoring should continue until closure activities are completed. At that time, a re-evaluation of post-closure activities is recommended.

8.0 RECOMMENDATIONS FOR FURTHER ACTION

8.0 RECOMMENDATION FOR FURTHER ACTION

Information gathered during the PA/SI investigation indicates that contaminants are being released from the Olin site via groundwater and surface water pathways. This site has been investigated thoroughly by Olin and, as a result, much useful information has been gathered to support remedial design. The ongoing work by Olin has also pointed to a few areas that should receive further attention, however. These areas include the on-site wetland (south-ditch complex), alledged drum disposal areas, and Tank Farm 1. Based on Wehran's review of existing data on this site, the following subtasks should be evaluated for inclusion in the ongoing remedial work by Olin:

- Surface water and sediment sampling of the wetland south of the current lagoons.
- A geophysical survey to identify possible drum burial areas north of Lagoon 2.
- Soil borings in the vicinity of Tank Farm 1 to determine potential for leakage from tank storage areas and extent of soil contamination.
- Inclusion of the hydrogeologic data obtained from the 10 monitoring wells installed in 1986 to evaluate the potential for contaminant migration off site.
- Survey and possible sampling and analysis of private and public wells located in the immediate vicinity of the site. This survey may also call attention to the bedrock aquifer, if used.
- Development of investigative procedures to define contaminant plume characteristics.
- Development of remedial alternatives to control or remove residual contamination remaining from previous site disposal activities.

9.0 HAZARD RANKING SYSTEM

Facility Name: Olin Chemical

Location: 51 Eames Street, Wilmington, Massachusetts

EPA Region: I

Person(s) in Charge of the Facility: Mr. David Vaughan

Name of Reviewer: David Tompkins **Date:** September 22, 1986

General Description of the Facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

The Olin Chemical site is a manufacturing facility where organic and inorganic compounds are utilized in the plastics industry. Past disposal practices at the site have included acid waste deposition in pits, use of unlined lagoons, and direct placement of waste into drainage ditches. In addition, there is a sludge landfill in the southwest corner of the site.

Both municipal and community wells are located within one mile of the site. Monitoring wells located on site have indicated the presence of organic and inorganic compounds in the groundwater reserve. Documented discharges of groundwater to the surface water route increases the potential for contaminant migration off site.

Scores: $S_M = 42.49$ ($S_{gw} = 73.08$ $S_{sw} = 7.97$ $S_a = 0.00$)

$S_{FE} = 0.00$

$S_{DC} = 0.00$

HRS COVER SHEET

GROUND WATER ROUTE WORK SHEET

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	0 45	1	45	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 3	2	6	6	
Net Precipitation	0 1 2 3	1	2	3	
Permeability of the Unsaturated Zone	0 1 2 3	1	2	3	
Physical State	0 1 2 3	1	3	3	
	Total Route Characteristics Score		13	15	
3 Containment	0 1 2 3	1	3	3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 12 15 18	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1	1	8	
	Total Waste Characteristics Score		19	26	
5 Targets					3.5
Ground Water Use	0 1 2 3	3	9	9	
Distance to Nearest Well/Population Served	0 4 6 8 10 / 12 16 18 20 / 24 30 32 35 40	1	40	40	
	Total Targets Score		49	49	
6 If line 1 is 45, multiply 1 x 4 x 5; If line 1 is 0, multiply 2 x 3 x 4 x 5			41,895	57.330	
7 Divide line 6 by 57.330 and multiply by 100	S_{gw} = 73.08				

SURFACE WATER ROUTE WORK SHEET

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
$\boxed{1}$ Observed Release	0 45	1	45	45	4.1
If observed release is given a value of 45, proceed to line $\boxed{4}$. If observed release is given a value of 0, proceed to line $\boxed{2}$.					
$\boxed{2}$ Route Characteristics					4.2
Facility Slope and Intervening Terrain	0 1 2 3	1	3	3	
1-yr. 24-hr. Rainfall	0 1 2 3	1	2	3	
Distance to Nearest Surface Water	0 1 2 3	2	6	6	
Physical State	0 1 2 3	1	3	3	
	Total Route Characteristics Score		14	15	
$\boxed{3}$ Containment	0 1 2 3	1	3	3	4.3
$\boxed{4}$ Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 9 12 15 18	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1	1	8	
	Total Waste Characteristics Score		19	26	
$\boxed{5}$ Targets					4.5
Surface Water Use	0 1 2 3	3	6	9	
Distance to a Sensitive Environment	0 1 2 3	2		6	
Population Served/Distance to Water Intake Downstream	0 4 6 8 10 / 12 16 18 20 / 24 30 32 35 40	1	0	40	
	Total Targets Score		6	55	
$\boxed{6}$ If line $\boxed{1}$ is 45, multiply $\boxed{1}$ x $\boxed{4}$ x $\boxed{5}$ / If line $\boxed{1}$ is 0, multiply $\boxed{2}$ x $\boxed{3}$ x $\boxed{4}$ x $\boxed{5}$			5,130	64,350	
$\boxed{7}$ Divide line $\boxed{6}$ by 64,350 and multiply by 100	S_{sw} = 7.97				

AIR ROUTE WORK SHEET

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	0 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line 1 is 0, the S = 0. Enter on line 5. If line 1 is 45, then proceed to line 2.					
2 Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
3 Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
4 Multiply 1 x 2 x 3				35,100	
5 Divide line 4 by 35,100 and multiply by 100 S_a = 0.00					

	S	S^2
Groundwater Route Score (S_{gw})	73.08	5,340.69
Surface Water Route Score (S_{sw})	7.97	63.52
Air Route Score (S_a)	0.00	0.00
$S_{gw}^2 + S_{sw}^2 + S_a^2$		5,404.21
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		73.51
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73$		$S_M =$ 42.49

WORKSHEET FOR COMPUTING S_M

FIRE AND EXPLOSION WORK SHEET N/A

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Containment	1 3	1		3	7.1
2 Waste Characteristics					7.2
Direct Evidence	0 3	1		3	
Ignitability	0 1 2 3	1		3	
Reactivity	0 1 2 3	1		3	
Incompatibility	0 1 2 3	1		3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score				20	
3 Targets					7.3
Distance to Nearest Population	0 1 2 3 4 5	1		5	
Distance to Nearest Building	0 1 2 3	1		3	
Distance to Sensitive Environment	0 1 2 3	1		3	
Land Use	0 1 2 3	1		3	
Population Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Buildings Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Total Targets Score				24	
4 Multiply 1 x 2 x 3				1,440	
5 Divide line 5 by 1,440 and multiply by 100	S_{FE} = 0.00				

DIRECT CONTACT WORK SHEET

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Incident	0 45	1	0	45	8.1
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2					
2 Accessibility	0 1 2 3	1	0	3	8.2
3 Containment	0 15	1	15	15	8.3
4 Waste Characteristics Toxicity	0 1 2 3	5	15	15	8.4
5 Targets					8.5
Population Within a 1-Mile Radius	0 1 2 3 4 5	4	12	20	
Distance to a Critical Habitat	0 1 2 3	4	0	12	
Total Targets Score			12	32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			0.00	21,600	
7 Divide line 6 by 21,600 and multiply by 100	S_{DC} = 0.00				

June 28, 1982

DOCUMENTATION RECORDS
FOR
HAZARD RANKING SYSTEM

INSTRUCTIONS: The purpose of these records is to provide a convenient way to prepare an auditable record of the data and documentation used to apply the Hazard Ranking System to a given facility. As briefly as possible summarize the information you used to assign the score for each factor (e.g., "Waste quantity = 4,230 drums plus 800 cubic yards of sludges"). The source of information should be provided for each entry and should be a bibliographic-type reference that will make the document used for a given data point easier to find. Include the location of the document and consider appending a copy of the relevant page(s) for ease in review.

FACILITY NAME: Olin Chemical

LOCATION: 51 Eames Street, Wilmington, Massachusetts

GROUND WATER ROUTE

1 OBSERVED RELEASE

Contaminants detected (5 maximum):

Analysis of groundwater samples in 1982 by Malcolm Pirnie, Inc. detected two organic volatiles and five base/neutral compounds in elevated concentration in groundwater samples. In addition, high concentrations of ammonia, chlorides, sulfates, and chrome were also detected in the semi-annual monitoring data. This data has been confirmed by subsequent analysis which detected similar parameters.

Score = 45

Source: References 2, 3, 4, 5

Rationale for attributing the contaminants to the facility:

Groundwater samples were obtained from on-site monitoring wells.

Source: References 2, 3, 4, 5

2 ROUTE CHARACTERISTICS

Depth to Aquifer of Concern

Name/description of aquifer(s) of concern:

Well logs are unavailable for the private wells located near the site. However, subsurface hydrogeologic investigations indicate that no confining layer exists between bedrock and unconsolidated aquifers. Assume hydraulic connection exists between aquifers.

Source: References 2, 3

Depth(s) from the ground surface to the highest seasonal level of the saturated zone (water table(s)) of the aquifer of concern:

Depth to water table is reported at 0-9 feet (Table 18 GEI).

Source: Reference 3

Depth from the ground surface to the lowest point of waste disposal/storage:

Waste was deposited in lagoon, landfill, acid pits, or directly into drainage ditches. Depth unknown; assume six feet. Conclusion, waste in contact with water table.

Score = 3

Source: References 2, 3

Net Precipitation

Mean annual or seasonal precipitation (list months for seasonal):

40.5 inches (reported by Malcolm Pirnie, 1982)

Source: Reference 2

Mean annual lake or seasonal evaporation (list months for seasonal):

26 inches

Source: Reference 4

Net precipitation (subtract the above figures):

13.5 inches

Score = 2

Source: Reference 4

Permeability of Unsaturated Zone

Soil type in unsaturated zone:

Two principal sub-units have been identified: sand and glacial till.

Source: Reference 2

Permeability associated with soil type:

Site soils are quite variable. Ranges of permeability are 1.2×10^{-2} cm/sec to 7.2×10^{-5} cm/sec. Average permeability calculated at 6×10^{-3} cm/sec.

Score = 2

Source: Reference 2

Physical State

Physical state of substances at time of disposal (or at present time for generated gases):

Liquids, sludges = worst

Score = 3

Source: References 1, 2, 3

3 CONTAINMENT

<u>Containment</u>

Method(s) of waste or leachate containment evaluated:

In 1971, PVC line lagoons were installed at the site and used for waste disposal. Prior to that date, all waste materials were disposed of on site into acid pits or directly into drainage ditches. In 1979, GEI reported liners were deteriorating and leaking.

Source: Reference 3

Method with highest score:

No liner, unsound liner, unsound runoff diversion structures.

Score = 3

Source: Reference 4

4 WASTE CHARACTERISTICS

<u>Toxicity and Persistence</u>

Compound(s) evaluated:

Groundwater samples were found to contain elevated levels of bromoform, 1,2-dichloroethane, toluene, bis(2-ethylhexyl)phthalate (DOP), butylbenzyl phthalate, di-n-butyl phthalate, "N-nitrosodiphenylamine", dioctyldiphenylamine, ammonia, chloride, sulfate, and ammonia.

Source: References 2, 3, 4, 5

Compound with highest score:

Di-n-butylphthlate = 18
Bis(2-ethylhexyl)phthalate = 12
1,2-Dichloroethane = 12

Source: Reference 6

<u>Hazardous Waste Quantity</u>

Total quantity of hazardous substances at the facility, excluding those with a containment score of 0 (Give a reasonable estimate even if quantity is above maximum):

Presently, inadequate information is available to estimate total waste quantity deposited at the site since 1953. However, the presence of wastes at the site has been confirmed, so waste quantity will be scored a one.

Score = 1

Source: References 1, 2, 3, 4, 5

Basis of estimating and/or computing waste quantity:

See above

5 TARGETS

Ground Water Use

Use(s) of aquifer(s) of concern within a 3-mile radius of the facility:

Drinking water

Score = 3

Source: Reference 7

Distance to Nearest Well

Location of nearest well drawing from aquifer of concern or occupied building not served by a public water supply:

An estimated 20 homes are within 2,000 feet of the site. These homes are located southwest of the site along Main Street and north of the Town line (see Reference 7).

Source: References 7, 8

Distance to above well or building:

Within 1,400 feet of the manufacturing facility and within 200-400 feet of the landfill area.

Value = 4

Source: References 1, 8

Population Served by Ground Water Wells Within a 3-Mile Radius

Identified water-supply well(s) drawing from aquifer(s) of concern within a 3-mile radius and populations served by each:

Wilmington Only

20 homes served by private wells x 3.8 people/homes = 76 people.
Municipal system - 4 wells - 17,000+ people.

Source: References 7, 8, 12

Computation of land area irrigated by supply well(s) drawing from aquifer(s) of concern within a 3-mile radius, and conversion to population (1.5 people per acre):

No documentation on irrigation within three miles has been obtained. Area has a high density of commercial and residential properties; no agricultural uses or areas have been identified.

Source: Reference 1 and File Review

Total population served by ground water within a 3-mile radius:

Wilmington Only

20 private homes = 76 people
Municipal wells = 17,000+ people.
USGS house count indicates a population in excess of 21,790 people. All municipalities in area of concern use groundwater. Score based on house count data.

Population = 21,790+

Value = 5

Score = 40

Source: References 7, 8, 9, 12

SURFACE WATER ROUTE

1 OBSERVED RELEASE

Contaminants detected in surface water at the facility or downhill from it (5 maximum):

Analysis of surface water samples detected bis(2-ethylhexyl)phthalate, dioctyldiphenylamine, and N-nitrosodiphenylamine in elevated concentrations. Other organics were also detected in low concentrations or in upgradient samples. Semi-annual monitoring data suggests contamination by ammonia, sulfate, chlorides, and chrome.

Score = 45

Source: References 2, 3, 4, 5

Rationale for attributing the contaminants to the facility:

Data from Malcolm Pirnie suggest base/neutrals are being released into the east ditch (Class B water). Probable sources are leakage from the banks near the northeast storage tanks and from contaminated groundwater discharge. Semi-annual monitoring stations are located along drainage ditches.

Source: References 2, 3, 4, 5

2 ROUTE CHARACTERISTICS

<u>Facility Slope and Intervening Terrain</u>

Average slope of facility in percent:

In the northern half of site slopes range from 0-8 percent towards the south. The central wetland area is relatively flat 0-3 percent. The southern section used as a landfill area has slopes up to 30 percent. Assume average slope = 10 percent.

Source: Reference 1

Name/description of nearest downslope surface water:

Three drainage ditches are located at the site. These ditches merge and carry water approximately 0.9 miles downgradient of the site into Hall's Brook. Hall's Brook flows 0.2 miles before merging with the Aberjona River. Further downstream (5.7 miles), Aberjona River flows into Mystic Lake.

Source: References 1, 3

Average slope of terrain between facility and above-cited surface water body in percent:

Terrain sloping toward the drainage ditch is estimate at 15 percent (from the tank farms). Terain sloping towards the wetland are is estimated at 5-8 percent (from the lagoons).

Score = 3

Source: Reference 1

Is the facility located either totally or partially in surface water?

No, the facility is located adjacent to drainage ditches and 12-15 acres of wetland area.

Source: Reference 1

Is the facility completely surrounded by areas of higher elevation?

No, higher elevations only to the north and southwest of the site.

Source: Reference 1

1-Year 24-Hour Rainfall in Inches

25 inches

Score = 2

Source: Reference 4

Distance to Nearest Downslope Surface Water

Three dainage ditches are located at the site. The last ditch is adjacent to the tank farm (distance = 20 feet). The lagoons are approximately 75 feet from the wetland and the landfill is 100 feet from the wetland.

Source: Reference 1

Physical State of Waste

Waste types disposed at the site included liquids, sludges, and suspended solids.

Worst = sludge, liquid

Score = 3

Source: Reference 1, 2, 3

3 CONTAINMENT

Containment

Method(s) of waste or leachate containment evaluated:

Lagoons - diking apparently sound, lagoons lined, freeboard appears adequate.
Landfill - no diversion system, sludge piles uncovered, adequacy of cover material.
Tanks - containers sealed, in sound condition, and surrounded by containment structures.

Source: Reference 1, 2, 3

Method with highest score:

Landfill - no diversion, sludge uncovered, adequacy of cover.
Lagoon - file documents indicate liners may be leaking.

Score = 3

Source: Reference 4

4 WASTE CHARACTERISTICS

Toxicity and Persistence

Compound(s) evaluated

Trichloroethane
Dichlorethylene
Chrome (Cr^{+6})
Bis(2-ethylhexyl)phthalate
Dioctyldiphenylamine
N-nitrosodiphenylamine

Source: References 2, 3, 4, 5

Compound with highest score:

Chrome (Cr^{+6}) = 18
Dichlorethylene = 12
Trichloroethylene = 15
Bis(2-ethylhexyl)phthalate = 12
N-nitrosodiphenylamine = 12

Score = 18

Source: Reference 6

Hazardous Waste Quantity

Total quantity of hazardous substances at the facility, excluding those with a containment score of 0 (Give a reasonable estimate even if quantity is above maximum);

Presently, inadequate information is available to estimate total waste quantity deposited at the site since 1953. However, the presenceof wastes at the site has been confirmed, so waste quantity will be scored a one.

Score = 1

Source: References 2, 3

Basis of estimating and/or computing waste quantity:

See above

5 TARGETS

Surface Water Use

Use(s) of surface water within 3 miles downstream of the hazardous substance:

The east ditch, Hall's Brook, and the Abjerona River are all Class B surface water suitable for recreation.

Score = 2

Source: Reference 10

Is there tidal influence?

Not applicable

Source: Reference 8

Distance to a Sensitive Environment

Distance to 5-acre (minimum) coastal wetland, if 2 miles or less:

Not applicable

Source: Reference 8

Distance to 5-acre (minimum) fresh-water wetland, if 1 mile or less:

There is an estimated ±12-acre wetland located on the site. Distance = 0.

Score = 3

Source: References 1, 8

Distance to critical habitat of an endangered species or national wildlife refuge, if 1 mile or less:

Not applicable

Source: Reference 13

Population Served by Surface Water

Location(s) of water-supply intake(s) within 3 miles (free-flowing bodies) or 1 mile (static water bodies) downstream of the hazardous substance and population served by each intake:

Contacts with the local health departments have indicated that there is no present use of surface water within the vicinity of the site.

Source: Reference 11

Computation of land area irrigated by above-cited intake(s) and conversion to population (1.5 people per acre):

No documentation on irrigation within three miles has been obtained. Area has a high density of commercial and residential properties; no agricultural uses have been identified.

Source: Reference 1 and File Review

Total population served:

Presently, no populations are served by surface water.

Source: Reference 1 and File Review

Name/description of nearest of above water bodies:

Not applicable

Distance to above-cited intakes, measured in stream miles:

Not applicable - no intakes

AIR ROUTE

1 OBSERVED RELEASE

Contaminants detected:

To score an air release, qualitative air sampling is required along with details on the sampling protocol and the meteorological conditions during the time of sampling. No qualitative air sampling has been performed.

Score = 0

Source: File Review and Reference 1

Date and location of detection of contaminants:

Not applicable

Methods used to detect the contaminants:

Not applicable

Rationale for attributing the contaminants to the site:

Not applicable

2 WASTE CHARACTERISTICS

Reactivity and Incompatibility

Most reactive compound:

Not applicable

Most incompatible pair of compounds:

Not applicable

Toxicity

Most toxic compound:

Not applicable

Hazardous Waste Quantity

Total quantity of hazardous waste:

Not applicable

Basis of estimating and/or computing waste quantity:

Not applicable

3 TARGETS

Population Within 4-Mile Radius

Circle radius used, give population, and indicate how determined:

0 to 4 mi	0 to 1 mi	0 to 1/2 mi	0 to 1/4 mi

Not applicable

Distance to a Sensitive Environment

Distance to 5-acre (minimum) coastal wetland, if 2 miles or less:

Not applicable

Distance to 5-acre (minimum) fresh-water wetland, if 1 mile or less:

Not applicable

Distance to critical habitat of an endangered species, if 1 mile or less:

Not applicable

Land Use

Distance to commercial/industrial area, if 1 mile or less:

Not applicable

Distance to national or state park, forest, or wildlife reserve, if 2 miles or less:

Not applicable

Distance to residential area, if 2 miles or less:

Not applicable

Distance to agricultural land in production within past 5 years, if 1 mile or less:

Not applicable

Distance to prime agricultural land in production within past 5 years, if 2 miles or less:

Not applicable

Is a historic or landmark site (National Register of Historic Places and National Natural Landmarks) within the view of the site?

Not applicable

FIRE AND EXPLOSION

1 CONTAINMENT

Hazardous substances present:

To score the fire and explosion hazard mode either a state or local fire marshall must have certified that the facility presents a significant fire or explosion threat to the public or to a sensitive environment, or there must be a demonstrated threat based on field observations (e.g. combustible gas indicator readings). The available records give no indication that either one of these tasks has been done. Further, the available data do not suggest any imminent threat of fire and explosion at this site. Therefore the route score cannot be completed.

Source: Reference 1 and File Review

Type of containment, if applicable:

Not applicable

2 WASTE CHARACTERISTICS

Direct Evidence

Type of instrument and measurements:

Not applicable

Ignitability

Compound used:

Not applicable

Reactivity

Most reactive compound:

Not applicable

Incompatibility

Most incompatible pair of compounds:

Not applicable

Hazardous Waste Quantity

Total quantity of hazardous substances at the facility:

Not applicable

Basis of estimating and/or computing waste quantity:

Not applicable

3 TARGETS

Distance to Nearest Population

Not applicable

Distance to Nearest Building

Not applicable

Distance to Sensitive Environment

Distance to wetlands:

Not applicable

Distance to critical habitat

Not applicable

Land Use

Distance to commercial/industrial area, if 1 mile or less:

Not applicable

Distance to national or state park, forest, or wildlife reserve, if 2 miles or less:

Not applicable

Distance to residential area, if 2 miles or less:

Not applicable

Distance to agricultural land in production within past 5 years, if 1 mile or less:

Not applicable

Distance to prime agricultural land in production within past 5 years, if 2 miles or less:

Not applicable

Is a historic or landmark site (National Register of Historic Places and National Natural Landmarks) within the view of the site?

Not applicable

Population Within 2-Mile Radius

Not applicable

Buildings Within 2-Mile Radius

Not applicable

DIRECT CONTACT

1 OBSERVED INCIDENT

Date, location, and pertinent details of incident:

No documentation of an incident due to waste disposal practices at the Olin facility has been obtained.

Score = 0

Source: Reference 1 and File Review

2 ACCESSIBILITY

Describe type of barrier(s):

An eight-foot chain-link fence completely surrounds the site. Entry into the plant is controlled by a gate with an attendant or through the main office building past a receptionist. Waste storage areas (lagoons and drum areas) are also fenced within the perimeter fence.

Score = 0

Source: Reference 1

3 CONTAINMENT

Type of containment, if applicable:

During the site inspection, sludge in the landfill area was uncovered. Erosion has occurred in the sludge indicated. Cover was not occurring frequently.

Score = 15

Source: Reference 1

4 WASTE CHARACTERISTICS

Toxicity

Compounds evaluated:

Groundwater samples were found to contain elevated levels of cromoform, 1,2-dichloroethane, toluene, bis(2-ethylhexyl)phthalate (DOP), butylbenzyl phthalate, di-n-butyl phthalate, "N-nitrosodiphenylamine", dioctyldiphenyl-amine, ammonia, chloride, and sulfate.

Source: References 2, 3

Compound with highest score:

Di-n-butyl phthalate = 2
Ammonia = 3
1,2-dichloroethane = 3

Source: Reference 6

5 TARGETS

<u>Population within one-mile radius</u>

USGS house count - Wilmington Quad.
One mile - 452 houses x 3.8 people/house = 2,000 people

Score = 3

Source: Reference 9

Source: Reference
<u>Distance to critical habitat (of endangered species)</u>

Presently, no critical habitats have been identified.

Score = 0

Source: Reference 13

Reference 1.9

8.0 MONITORING/OBSERVATION WELLS

8.1 Number of On-Site Wells: 36

Diameter and Materials: 2½" PVC metal cased

8.2 Number of Off-Site Wells: Unknown

Diameter and Materials ______

8.3 Well Identification and Inspection (Include on-site sketch)

*see text

Well No.	Location/ Gradient	Total Depth	Screen Interval	Top of Water	-	Stickup	=	Depth to Water
					-		=	
					-		=	
					-		=	
					-		=	
					-		=	
					-		=	
					-		=	
					-		=	
					-		=	

Water Level (ft)[1] applies to Top of Water - Stickup = Depth to Water.

[1]Measurements taken during site inspection to accuracy of 0.01 ft.

8.4 Water Level Instrument/Method:

______

______

8.5 Condition of Wells/Seals:

See text

8.6 Well Records (from site owner, operator, or contractor)

Wells Installed by (Driller): See text

Installed for:

Tested by (lab):

Data Obtained by WE (yes/no):

Boring Logs Obtained by WE (yes/no):

8.7 Headspace HNU/OVA Readings

Well No.	Reading (ppm)	Classification
Background		None taken from wells

Reference 1.11

9. COMMENTS AND INTERVIEW NOTES (IDENTIFY SOURCES)

Solvent type odor detected on north section of site. The odor was coming from upwind (off-site) sources. Wind direction towards the south.

APPENDIX A

REFERENCES FOR HAZARD RANKING SYSTEM

REFERENCE 1

WE WEHRAN ENGINEERS & SCIENTISTS
666 EAST MAIN STREET
P.O. BOX 2006
MIDDLETOWN, NY 10940

①

Reference 1.1

WEHRAN ENGINEERING - SITE INSPECTION FORM

1. IDENTIFICATION

Olin Chemical	Middlesex
Site Name	County
8601 086 093	I
Mass. Number	EPA Region

2. LOCATION

51 Eames Street	Wilmington
Street/Route No.	Town
City	Village
Wilmington	
USGS Quadrangle	

3. INSPECTION

9/16/86	10:00 A.M.
Date of Inspection	Time of Inspection

Cool, cloudy
Weather Conditions and Snow Cover

WE Inspectors (Name)	Title	Phone Number
David B. Tompkins	Environmental Scientist	(914) 343-0660
Michael F. Richter	Environmental Scientist	(914) 343-0660

Other Inspectors (Name)	Affiliation	Phone Number

Reference 1.2

Site Reps. Interviewed	Affiliation	Phone Number
Mr. Carl Nelson	Assc. Sepc., Env. Affairs	(615) 336-4559
Mr. Mark Townley	Production superintendant	(617) 933-4240

4. SITE DESCRIPTION

4.1 Site History as of September 1986 **Active** ___ **Inactive** X

Years of Operation: 1980-1986

Owner(s): Olin Chemical Corporation
P.O. Box 248
Charleston, TN 37310

1971 - 1980 Stephan Chemical Company
1953-1971 National Polychemical

4.2 Storage/Disposal (Check all that apply)

			Size/Amount	Unit of Measure
X	A.	Surface Impoundment	Two Surface Lagoons	Unknown
	B.	Piles		
X	C.	Drums, Above Ground	Three Storage pads	Unknown
X	D.	Tank, Above Ground	12-15,000 gal.	
	E.	Tank, Below Ground		
X	F.	Landfill	Est. 5 acre	
	G.	Landfarm		
	H.	Open Dump		
	I.	Spill		
	J.	Well Field		
	K.	Other (______________)		

Reference 1.3

4.3 Treatment (Check all that apply)

- __ A. Burning
- __ B. Incineration
- __ C. Underground Injection
- __ D. Chemical/Physical/Biological
- __ E. Waste Oil Processing
- __ F. Solvent Recovery
- __ G. Other Recycling/Recovery
- __ H. Other (________________)

4.4 Waste Substances Observed (include hazardous)

Calcuim Sulfate sludge

Other chemicals/compounds were in tanks/drums and represent raw material.

4.5 Containment of Wastes (describe)

Sludge was observed in disposal lagoons and as a dry precipitant in a landfill disposal.

4.6 Accessibility of Public to Wastes (describe)

Site is fenced by 8 ft. chainlink fence

Entrance to manufacturing area controlled by guard.

Drum storage areas for waste materials are also fenced to form storage pads.

5. ENVIRONMENTAL MEASUREMENTS (DURING INSPECTION)

5.1 HNU/OVA Readings (Note locations on site sketch)

Location	Value (ppm)	Classification
Background		
No reading above		
background		

Method/Instrument: HNU Photoionization

5.2 Site Topography (Describe relative to regional features)

Site is located in a commercial area with homes to the NE and SW.

Wetland area is located between sludge lagoons and landfill area.

Other wetland areas are within one mile. Railroad tracks are located on east and west side of the site.

Reference 1.5

5.3 Site Slope (percent)

	Reading (Percent)
Read from highest disposal area surface to edge of disposal area.	
If disposal area is within enclosed basin, report as zero.	
Landfill to wetland	up to 30%
Manufacturing area	0-3
Average	10%

5.4 Prevailing Direction of Site Slope South

5.5 Distance to Nearest Downslope Surface Waters (from edge of disposal area)

Name/Description	Distance	Units	Permanent/Intermittent
East ditch	adjacent		Permanent

5.6 Intervening Terrain Slope to Nearest Downslope Waters (from edge of disposal area)

Name/Description	Reading (Percent)
East ditch from Tank farm 1	15%
Wetland from lagoons	15%

5.7 Distance to Nearest Downslope Wetlands (5-acre minimum)

Size (Acres)	Distance	Units
12-15 acre (est.)	adjacent	

Reference 1.6

5.8 Distance to Critical Habitat (endangered species)

Name/Location	Distance	Units
Unknown		

5.9 Observed Site Geology (Describe from visual observations)

Overburden (soils)	see Hydrogeology Section
Bedrock	
Depth to Rock	outcrops noted in SW corner

5.10 Distance to Nearest Potable Well (Identify on topographic map)

Type (Private/Community/Municipal)	Distance	Units
Commercial buildings on Jewel Drive	200	feet
Private homes NE of site	400	feet
Private homes SW of site	500	feet

5.11 Distance to Nearest Off-Site Building

Along Jewel drive 200 ft. ~~miles.~~

5.12 Describe Source and Use of Water on Site

Groundwater was used as non-process cooling water at one time.

Presently, no use.

Reference 1.7

6.0 LAND USE

6.1 Distance to Nearest:

Residential Area	400 ft. ~~miles~~
Commercial/Industrial	200 ft. ~~miles~~
Recreation Use	______ miles
Forest	______ miles
Wildlife Reserve	______ miles
Historic/Landmark Site	______ miles
Prime Agricultural Land	______ miles
Agricultural Land	______ miles

7.0 SITE EVALUATION

7.1 Landfills/Open Dumps/Piles (Use N/A if not applicable)

Adequacy of Cover: Revegetation on older section good, present area uncovered and eroding, cover material quite sandy

Adequacy of Runoff Diversion: None present at site.

Potential/Observed Ponding: None observed

Waste Piles Stabilized/Unstabilized: Erosion noted on uncovered sludge

Permeability/Compatibility of Liner: No liner present

Observed Seeps: None observed

Adequacy of Leachate Collection: N/A

Adequacy of Run-On Controls: N/A

7.2 Surface Impoundments Size/Capacity

Adequacy of Diking/Diversion Structures: None observed

Adequacy of Freeboard: Lagoons are presently being emptied, not able to evaluate.

Potential/Observed Leaking: None

Permeability/Compatibility of Liner: Unknown

Adequacy of Run-On Control: None present

Adequacy of Leachate Collection System: None observed

7.3 **Containers**

Number and Type of Containers Observed: Three drum storage pads, 2 tank farms (6-15,000 gal tanks each).

Container Condition: Good

Observed Leaking (during inspection): N/A

Evidence of Previous Ground Spills:

Evidence of Underground Tank Leaking: N/A

Adequacy of Containment/Diversion Structures: N/A

10.0 USEPA SITE INSPECTION REPORT 2070-13

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 1 - SITE LOCATION AND INSPECTION INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
MA	D001403104

II. SITE NAME AND LOCATION

01 SITE NAME (Legal, common, or descriptive name of site)	02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER
Olin Chemical	51 Eames Street

03 CITY	04 STATE	05 ZIP CODE	06 COUNTY	07 COUNTY CODE	08 CONG DIST
Wilmington	MA	01887	Middlesex		

09 COORDINATES: LATITUDE 42° 30' 48". N LONGITUDE 71° 09' 10". W

10 TYPE OF OWNERSHIP (Check one): ☒ A. PRIVATE ☐ B. FEDERAL ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL ☐ F. OTHER ☐ G. UNKNOWN

III. INSPECTION INFORMATION

01 DATE OF INSPECTION	02 SITE STATUS	03 YEARS OF OPERATION
9 / 16 / 86 (MONTH DAY YEAR)	☐ ACTIVE ☒ INACTIVE	1953 (BEGINNING YEAR) / 1986 (ENDING YEAR) ___ UNKNOWN

04 AGENCY PERFORMING INSPECTION (Check all that apply)

☐ A. EPA ☐ B. EPA CONTRACTOR ☐ C. MUNICIPAL ☐ D. MUNICIPAL CONTRACTOR

☐ E. STATE ☒ F. STATE CONTRACTOR Wehran Engineering (Name of firm) ☐ G. OTHER (Specify)

05 CHIEF INSPECTOR	06 TITLE	07 ORGANIZATION	08 TELEPHONE NO.
David B. Tompkins	Environmental Scientist	Wehran Eng.	(914) 343-0660
09 OTHER INSPECTORS	**10 TITLE**	**11 ORGANIZATION**	**12 TELEPHONE NO.**
Michael F. Richter	Environmental Scientist	Wehran Eng.	(914) 343-0660
			( )
			( )
			( )
			( )

13 SITE REPRESENTATIVES INTERVIEWED	14 TITLE	15 ADDRESS	16 TELEPHONE NO
Carl Nelson	Spec. Env. Aff.	Olin Chemical Group Charleston, TN	(615) 336-4559
Mike Townley	Plant Superintendant	Olin Chemical Group Wilmington, MA	(617) 933-4240
			( )
			( )
			( )
			( )

17 ACCESS GAINED BY (Check one)	18 TIME OF INSPECTION	19 WEATHER CONDITIONS
☒ PERMISSION ☐ WARRANT	10:00 A.M.	cool, cloudy

IV. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF (Agency/Organization)	03 TELEPHONE NO.
Harish Panchal	MDEQE	(617) 292-5785

04 PERSON RESPONSIBLE FOR SITE INSPECTION FORM	05 AGENCY	06 ORGANIZATION	07 TELEPHONE NO.	08 DATE
David B. Tompkins		Wehran Eng.	(914) 343-0660	9 / 22 / 86 (MONTH DAY YEAR)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
MA	D001403104

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)

- [x] A. SOLID
- [x] B. POWDER, FINES
- [x] C. SLUDGE
- [ ] D. OTHER ________ (Specify)
- [ ] E. SLURRY
- [x] F. LIQUID
- [x] G. GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)

TONS ________
CUBIC YARDS ________
NO. OF DRUMS ________

03 WASTE CHARACTERISTICS (Check all that apply)

- [x] A. TOXIC
- [x] B. CORROSIVE
- [ ] C. RADIOACTIVE
- [x] D. PERSISTENT
- [ ] E. SOLUBLE
- [ ] F. INFECTIOUS
- [ ] G. FLAMMABLE
- [ ] H. IGNITABLE
- [ ] I. HIGHLY VOLATILE
- [ ] J. EXPLOSIVE
- [ ] K. REACTIVE
- [ ] L. INCOMPATIBLE
- [ ] M. NOT APPLICABLE

III. WASTE TYPE

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE			Calcium Hydroxide
OLW	OILY WASTE			
SOL	SOLVENTS			
PSD	PESTICIDES			
OCC	OTHER ORGANIC CHEMICALS			
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS			

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers)

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION
	anhydrous ammonia	7664417			
ACD	hydrochloric acid	7647010	Tank		
	liquid chlorine	778205	Tank		
ACD	sulfuric acid	7664939	Tank		
	formaldehyde	50000	Tank		
	sodium nitrate	7632000	Tank		
	sodium chloride	7647145	Tank		
	sodium hycloxide	1310732			
	nonyl phenol	25154523	Tank		
	aluminum hydroxide	21645512			
	aluminum chloride	7446700			
	diphenylamic	122394			
ACD	chlorosulfonic acid	7790945			
	urea	57136			
OLW	hydrozene	302012	Tank		
	dioclylphthlate	117840	Tank		

V. FEEDSTOCKS (See Appendix for CAS Numbers)

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

DEQE File documents, Woburn office
Ecology and Environment, Inc., 1980. Field investigations of uncontrolled hazardous waste sites

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
MA	D001403104

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 ☒ A. GROUNDWATER CONTAMINATION 02 ☒ OBSERVED (DATE: 2/1982) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

Past waste disposal practices have resulted in wastes contacting the water table. Analysis by Malcolm Pirnie (1982) has indicated the presence of inorganic and organic contaminants in the groundwater reserve.

01 ☒ B. SURFACE WATER CONTAMINATION 02 ☒ OBSERVED (DATE: 2/1982) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

Monitoring of the surface water at the site indicates that discharge of contaminants has occurred along the east side of the site. Discharge has occurred from potential release from storage tanks and from groundwater contribution to the East Ditch (Class B water).

01 ☒ C. CONTAMINATION OF AIR 02 ☐ OBSERVED (DATE: ______) ☒ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

No quantitative air sampling has occurred. However, a known release of hydrogen chloride occurred on November 18, 1985, which required evacuation. Town of Wilmington Health Department files indicate history of complaints from odors.

01 ☒ D. FIRE/EXPLOSIVE CONDITIONS 02 ☐ OBSERVED (DATE: ______) ☒ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

Several chemicals on the site are known to be strong oxidizing agents.

01 ☐ E. DIRECT CONTACT 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

Unknown

01 ☒ F. CONTAMINATION OF SOIL 02 ☐ OBSERVED (DATE: ______) ☒ POTENTIAL ☐ ALLEGED
03 AREA POTENTIALLY AFFECTED: ______ (Acres) 04 NARRATIVE DESCRIPTION

Approximately 20 cubic yards of soil were removed in 1982. Potential exists for additional soil contamination due to leeaking PVC liners in lagoons.

01 ☒ G. DRINKING WATER CONTAMINATION 02 ☐ OBSERVED (DATE: ______) ☒ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

Groundwater is used for drinking within 400 feet of the site. No analytical testing of private wells has occurred. Municipal water wells are also within one mile.

01 ☒ H. WORKER EXPOSURE/INJURY 02 ☒ OBSERVED (DATE: June 16,1978) ☐ POTENTIAL ☐ ALLEGED
03 WORKERS POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

On above date, a worker was overcome by fumes vented from a building where blowing agents were utilized. Exposure to fumes resulted in worker falling.

01 ☒ I. POPULATION EXPOSURE/INJURY 02 ☐ OBSERVED (DATE: ______) ☒ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

No documentation of an incident. However, in November 1985, the area surrounding the site had to be evacuated due to release of gasses when a stack scrubber malfunctioned.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION
01 STATE: MA
02 SITE NUMBER: D001403104

II. HAZARDOUS CONDITIONS AND INCIDENTS (Continued)

01 [X] J. DAMAGE TO FLORA — 02 [ ] OBSERVED (DATE: ______) [ ] POTENTIAL [ ] ALLEGED
04 NARRATIVE DESCRIPTION
Several file documents indicate flora stress is visible near where the acid pits were formerly located.

01 [ ] K. DAMAGE TO FAUNA — 02 [ ] OBSERVED (DATE: ______) [ ] POTENTIAL [ ] ALLEGED
04 NARRATIVE DESCRIPTION (include name(s) of species)
Unknown

01 [ ] L. CONTAMINATION OF FOOD CHAIN — 02 [ ] OBSERVED (DATE: ______) [ ] POTENTIAL [ ] ALLEGED
04 NARRATIVE DESCRIPTION
Unknown

01 [X] M. UNSTABLE CONTAINMENT OF WASTES (Spills/Runoff/Standing liquids, Leaking drums) — 02 [ ] OBSERVED (DATE: ______) [ ] POTENTIAL [ ] ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION
Previous waste disposal practices included dumping into unlined pits and open ditches which contained surface water.

01 [X] N. DAMAGE TO OFFSITE PROPERTY — 02 [ ] OBSERVED (DATE: ______) [X] POTENTIAL [ ] ALLEGED
04 NARRATIVE DESCRIPTION
Contaminated surface water flows into Hall's Brook and further downstream into Aberjona River. Impact on downstream environments unknown.

01 [X] O. CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs — 02 [ ] OBSERVED (DATE: ______) [X] POTENTIAL [ ] ALLEGED
04 NARRATIVE DESCRIPTION
Non-sulfate wastes generated on-site are released into the municipal sewer system. Reportedly, complaints regarding high chloride, sulfate, and ammonia levels in the sewer effluent have been made on several occassions.

01 [ ] P. ILLEGAL/UNAUTHORIZED DUMPING — 02 [ ] OBSERVED (DATE: ______) [ ] POTENTIAL [ ] ALLEGED
04 NARRATIVE DESCRIPTION
Site is entirely fenced with guards controlling access gates. Illegal dumping is not likely.

05 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS
Unknown

III. TOTAL POPULATION POTENTIALLY AFFECTED: +20,000

IV. COMMENTS

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Geotechnical Engineers, Inc. Report on Groundwater and Surface Water Study, Stepan Chemical Company, Wilmington, MA, December 1978.
Malcolm Pirnie, Inc. Hydrologic Investigation of Olin Chemical, February 1982
DEQE RCRA file, Woburn office

EPA

POTENTIAL HAZARDOUS WASTE SITE SITE INSPECTION
PART 4 - PERMIT AND DESCRIPTIVE INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
MA	D001403104

II. PERMIT INFORMATION

01 TYPE OF PERMIT ISSUED (Check all that apply)	02 PERMIT NUMBER	03 DATE ISSUED	04 EXPIRATION DATE	05 COMMENTS
☒ A. NPDES				
☐ B. UIC				
☒ C. AIR				
☐ D. RCRA				
☐ E. RCRA INTERIM STATUS				
☐ F. SPCC PLAN				
☐ G. STATE (Specify)				
☐ H. LOCAL (Specify)				
☒ I. OTHER (Specify)				Landfill - DEQE
☐ J. NONE				

III. SITE DESCRIPTION

01 STORAGE/DISPOSAL (Check all that apply)	02 AMOUNT	03 UNIT OF MEASURE
☒ A. SURFACE IMPOUNDMENT		
☐ B. PILES		
☐ C. DRUMS, ABOVE GROUND		
☒ D. TANK, ABOVE GROUND		
☐ E. TANK, BELOW GROUND		
☒ F. LANDFILL		
☐ G. LANDFARM		
☐ H. OPEN DUMP		
☐ I. OTHER (Specify)		

04 TREATMENT (Check all that apply)

- ☐ A. INCINERATION
- ☐ B. UNDERGROUND INJECTION
- ☒ C. CHEMICAL/PHYSICAL
- ☐ D. BIOLOGICAL
- ☐ E. WASTE OIL PROCESSING
- ☐ F. SOLVENT RECOVERY
- ☒ G. OTHER RECYCLING/RECOVERY
- ☐ H. OTHER (Specify)

05 OTHER

- ☒ A. BUILDINGS ON SITE

06 AREA OF SITE

50 (Acres)

07 COMMENTS

Ten tanks are located on site and according to MDC records, the following were stored on-site as of June 1980: formaldehyde, nonyl phenol, dinonyl phenol, ethyl hexoic acid, dioctylphthlate, process oil, TNPP (wytox 312).

IV. CONTAINMENT

01 CONTAINMENT OF WASTES (Check one)

☐ A. ADEQUATE, SECURE ☐ B. MODERATE ☒ C. INADEQUATE, POOR ☐ D. INSECURE, UNSOUND, DANGEROUS

02 DESCRIPTION OF DRUMS, DIKING, LINERS, BARRIERS, ETC.

Two PVC-lagoons are located on site with reports of leaking liners and overflowing conditions. Alleged spills in the tank storage areas are also reported.

V. ACCESSIBILITY

01 WASTE EASILY ACCESSIBLE: YES ☒ NO

02 COMMENTS a fence surrounds entire site and gates have attendants.

VI. SOURCES OF INFORMATION (Cite specific references, e.g. state files, sample analysis, reports)

Ecology and Environment, Inc., Field Investigations of Uncontrolled Hazardous Waste Sites, December 1980.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
MA	D001403104

II. DRINKING WATER SUPPLY

01 TYPE OF DRINKING SUPPLY (Check as applicable)

	SURFACE	WELL	02 STATUS: ENDANGERED	AFFECTED	MONITORED	03 DISTANCE TO SITE
COMMUNITY	A. ☐	B. ☒	A. ☐	B. ☐	C. ☐	A. 0.75 (mi)
NON-COMMUNITY	C. ☐	D. ☒	D. ☐	E. ☐	F. ☐	B. 0.10 (mi)

III. GROUNDWATER

01 GROUNDWATER USE IN VICINITY (Check one)

☐ A. ONLY SOURCE FOR DRINKING
☒ B. DRINKING (Other sources available) COMMERCIAL, INDUSTRIAL, IRRIGATION (No other water sources available)
☐ C. COMMERCIAL, INDUSTRIAL, IRRIGATION (Limited other sources available)
☐ D. NOT USED, UNUSEABLE

02 POPULATION SERVED BY GROUND WATER: 20,000+

03 DISTANCE TO NEAREST DRINKING WATER WELL: ±400 ft ~~(mi)~~

04 DEPTH TO GROUNDWATER: 0-9 (ft)

05 DIRECTION OF GROUNDWATER FLOW: Southeast

06 DEPTH TO AQUIFER OF CONCERN: 0-9 (ft)

07 POTENTIAL YIELD OF AQUIFER: ______ (gpd)

08 SOLE SOURCE AQUIFER: ☐ YES ☒ NO

09 DESCRIPTION OF WELLS (Including useage, depth, and location relative to population and buildings)

Presently 36 monitoring wells are located at the site. All wells are located in the unconsolidated aquifers. Approxmimately 20 private wells are located within 2,000 feet. One municipal well is located within one mile.

10 RECHARGE AREA: ☒ YES ☐ NO
COMMENTS: Recharge occurs through the infiltration of precipitation through the unconsolidated deposits.

11 DISCHARGE AREA: ☒ YES ☐ NO
COMMENTS: Groundwater discharges into the east and south ditches. Upward vertical movement has been noted near GW19

IV. SURFACE WATER

01 SURFACE WATER USE (Check one)

☒ A. RESERVOIR, RECREATION DRINKING WATER SOURCE
☐ B. IRRIGATION, ECONOMICALLY IMPORTANT RESOURCES
☐ C. COMMERCIAL, INDUSTRIAL
☐ D. NOT CURRENTLY USED

02 AFFECTED/POTENTIALLY AFFECTED BODIES OF WATER

NAME: East Drainage Ditch (Class B water) - - on site

NAME	AFFECTED	DISTANCE TO SITE
Hall's Brook	☐	0.9 (mi)
Abergona River	☐	1.1 (mi)
Mystic Lake	☐	6.8 (mi)

V. DEMOGRAPHIC AND PROPERTY INFORMATION

01 TOTAL POPULATION WITHIN — USGS house count

ONE (1) MILE OF SITE	TWO (2) MILES OF SITE	THREE (3) MILES OF SITE
A. 2,060 NO. OF PERSONS	B. 10,040 NO. OF PERSONS	C. 21,790 NO. OF PERSONS

02 DISTANCE TO NEAREST POPULATION: ±400 feet (mi)

03 NUMBER OF BUILDINGS WITHIN TWO (2) MILES OF SITE: 2,642

04 DISTANCE TO NEAREST OFF-SITE BUILDING: ±400 feet (mi)

05 POPULATION WITHIN VICINITY OF SITE (Provide narrative description of nature of population within vicinity of site, e.g., rural, village, densely populated urban area)

Closest homes SW and NE of site.
Total population within three miles is estimated to exceed 22,800 people.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
MA	D001403104

VI. ENVIRONMENTAL INFORMATION

01 PERMEABILITY OF UNSATURATED ZONE (Check one)

☐ A. $10^{-6} - 10^{-8}$ cm/sec ☐ B. $10^{-4} - 10^{-6}$ cm/sec ☐ C. $10^{-4} - 10^{-3}$ cm/sec ☒ D. GREATER THAN 10^{-3} cm/sec

02 PERMEABILITY OF BEDROCK (Check one)

☐ A. IMPERMEABLE (Less than 10^{-6} cm/sec) ☒ B. RELATIVELY IMPERMEABLE ($10^{-4} - 10^{-6}$ cm/sec) ☐ C. RELATIVELY PERMEABLE ($10^{-2} - 10^{-4}$ cm/sec) ☐ D. VERY PERMEABLE (Greater than 10^{-2} cm/sec)

03 DEPTH TO BEDROCK	04 DEPTH OF CONTAMINATED SOIL ZONE	05 SOIL pH
8-23 (ft)	unknown (ft)	unknown

06 NET PRECIPITATION	07 ONE YEAR 24 HOUR RAINFALL	08 SLOPE: SITE SLOPE	DIRECTION OF SITE SLOPE	TERRAIN AVERAGE SLOPE
13.5 (in)	2.5 (in)	5-10 %	South	5-10 %

09 FLOOD POTENTIAL

SITE IS IN 100 YEAR FLOODPLAIN

10 N/A ☐ SITE IS ON BARRIER ISLAND, COASTAL HIGH HAZARD AREA, RIVERINE FLOODWAY

11 DISTANCE TO WETLANDS (5 acre minimum)

ESTUARINE A. ______ (mi)

OTHER: Wetland on site B. 0 (mi)

12 DISTANCE TO CRITICAL HABITAT (of endangered species) ______ (mi)

ENDANGERED SPECIES: ______

13 LAND USE IN VICINITY

DISTANCE TO:

COMMERCIAL/INDUSTRIAL: A. adjacent (mi)

RESIDENTIAL AREAS; NATIONAL/STATE PARKS, FORESTS, OR WILDLIFE RESERVES: B. 0.25 (mi)

AGRICULTURAL LANDS: Unknown

PRIME AG LAND C. ______ (mi) AG LAND D. ______ (mi)

14 DESCRIPTION OF SITE IN RELATION TO SURROUNDING TOPOGRAPHY

A complex of manufacturing buildings are located on the northern section of the site. The Central section is a low-lying wetland area with a series of east-west drainage ditches. Additional ditches are located to the east and west. Southern section of site is wooded and landfill is located in SW corner.

Drainage from the site is to the sourth and into Hall's Brook which drains into the Aberjona River. Railroad tracks running north-south form the east and west boundries.

VII. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

DEQE, File Documents, Woburn Office

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 6 - SAMPLE AND FIELD INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
MA	D001403104

II. SAMPLES TAKEN

SAMPLE TYPE	01 NUMBER OF SAMPLES TAKEN	02 SAMPLES SENT TO	03 ESTIMATED DATE RESULTS AVAILABLE
GROUNDWATER	58	Geotechnical Eng. (DWPC)	Dec 1978
SURFACE WATER	57	Geotechnical Eng. (DWPC)	Dec 1978
WASTE (sludge)	3	Geotechnical Eng. (DWPC)	Dec 1978
AIR			
RUNOFF			
SPILL			
SOIL	5	Ecology and Environment (USEPA)	Dec 1980
VEGETATION			
OTHER			

III. FIELD MEASUREMENTS TAKEN

01 TYPE	02 COMMENTS
Explosivity	Ecology and Environment Consistently 0 results
O_2 Meter	Ecology and Environment Consistently 20 results
pH	Ecology and Environment 6-8

IV. PHOTOGRAPHS AND MAPS

01 TYPE ☒ GROUND ☐ AERIAL

02 IN CUSTODY OF Wehran Engineering (Name of organization or individual)

03 MAPS ☒ YES ☐ NO

04 LOCATION OF MAPS Wehran Engineering

V. OTHER FIELD DATA COLLECTED (Provide narrative description)

Quarterly monitoring data 1982 - present
Malcolm Pirnie (1982)

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

DEQE File Documents, Woburn Office

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 7 - OWNER INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
MA	D001403104

II. CURRENT OWNER(S) / **PARENT COMPANY** (if applicable)

01 NAME	02 D+B NUMBER	08 NAME	09 D+B NUMBER
Olin Chemical Group			
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	**04 SIC CODE**	**10 STREET ADDRESS** (P.O. Box, RFD #, etc.)	**11 SIC CODE**
Lower River Road, P.O. Box 248			
05 CITY / 06 STATE / 07 ZIP CODE		**12 CITY / 13 STATE / 14 ZIP CODE**	
Charleston, TN 37310			

01 NAME	02 D+B NUMBER	08 NAME	09 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	**04 SIC CODE**	**10 STREET ADDRESS** (P.O. Box, RFD #, etc.)	**11 SIC CODE**
05 CITY / 06 STATE / 07 ZIP CODE		**12 CITY / 13 STATE / 14 ZIP CODE**	

01 NAME	02 D+B NUMBER	08 NAME	09 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	**04 SIC CODE**	**10 STREET ADDRESS** (P.O. Box, RFD #, etc.)	**11 SIC CODE**
05 CITY / 06 STATE / 07 ZIP CODE		**12 CITY / 13 STATE / 14 ZIP CODE**	

01 NAME	02 D+B NUMBER	08 NAME	09 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	**04 SIC CODE**	**10 STREET ADDRESS** (P.O. Box, RFD #, etc.)	**11 SIC CODE**
05 CITY / 06 STATE / 07 ZIP CODE		**12 CITY / 13 STATE / 14 ZIP CODE**	

III. PREVIOUS OWNER(S) (List most recent first) / **IV. REALTY OWNER(S)** (If applicable; list most recent first)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
Stephan Chemical Company			
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	**04 SIC CODE**	**03 STREET ADDRESS** (P.O. Box, RFD #, etc.)	**04 SIC CODE**
Eames Street			
05 CITY / 06 STATE / 07 ZIP CODE		**05 CITY / 06 STATE / 07 ZIP CODE**	
Wilmington, MA 01887			

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	**04 SIC CODE**	**03 STREET ADDRESS** (P.O. Box, RFD #, etc.)	**04 SIC CODE**
05 CITY / 06 STATE / 07 ZIP CODE		**05 CITY / 06 STATE / 07 ZIP CODE**	

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	**04 SIC CODE**	**03 STREET ADDRESS** (P.O. Box, RFD #, etc.)	**04 SIC CODE**
05 CITY / 06 STATE / 07 ZIP CODE		**05 CITY / 06 STATE / 07 ZIP CODE**	

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

DEQE File Documents, Woburn Office

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 8 - OPERATOR INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
MA	D001403104

II. CURRENT OPERATOR (Provide if different from owner) / **OPERATOR'S PARENT COMPANY** (If applicable)

01 NAME	Olin Chemical Group	10 NAME	Olin Chemical Corporation
02 D+B NUMBER		11 D+B NUMBER	
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	51 Eames Street	12 STREET ADDRESS (P.O. Box, RFD #, etc.)	P.O. Box 248
04 SIC CODE		13 SIC CODE	
05 CITY	Wilmington	14 CITY	Charleston
06 STATE	MA	15 STATE	TN
07 ZIP CODE	01887	16 ZIP CODE	37310
08 YEARS OF OPERATION	1980-1986		
09 NAME OF OWNER	Olin Chemical Corporation		

III. PREVIOUS OPERATOR(S) (List most recent first; provide only if different from owner) / **PREVIOUS OPERATORS' PARENT COMPANIES** (If applicable)

01 NAME	Stephan Chemical Company	10 NAME	Olin Chemical Corporation
02 D+B NUMBER		11 D+B NUMBER	
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	51 Eames Street	12 STREET ADDRESS (P.O. Box, RFD #, etc.)	P.O. Box 248
04 SIC CODE		13 SIC CODE	
05 CITY	Wilmington	14 CITY	Charleston
06 STATE	MA	15 STATE	TN
07 ZIP CODE	01887	16 ZIP CODE	37310
08 YEARS OF OPERATION	1971-1980		
09 NAME OF OWNER DURING THIS PERIOD			

01 NAME	National Polychemical	10 NAME	Olin Chemical Corporation
02 D+B NUMBER		11 D+B NUMBER	
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	51 Eames Street	12 STREET ADDRESS (P.O. Box, RFD #, etc.)	P.O. Box 248
04 SIC CODE		13 SIC CODE	
05 CITY	Wilmington	14 CITY	Charleston
06 STATE	MA	15 STATE	TN
07 ZIP CODE	01887	16 ZIP CODE	37310
08 YEARS OF OPERATION	1953-1977		
09 NAME OF OWNER DURING THIS PERIOD			

01 NAME		10 NAME	
02 D+B NUMBER		11 D+B NUMBER	
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		12 STREET ADDRESS (P.O. Box, RFD #, etc.)	
04 SIC CODE		13 SIC CODE	
05 CITY		14 CITY	
06 STATE		15 STATE	
07 ZIP CODE		16 ZIP CODE	
08 YEARS OF OPERATION			
09 NAME OF OWNER DURING THIS PERIOD			

IV. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

DEQE File Documents, Woburn Office
Ecology and Environment, Inc., Dec. 1980, Field Investigations of Uncontrolled Hazardous Wastes Sites.
Site inspection report of Olin Chemical, Wilmington, MA

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - GENERATOR/TRANSPORTER INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
MA	D001403104

II. ON-SITE GENERATOR

01 NAME	02 D+B NUMBER
Olin Chemical Group	

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
51 Eames Street	

05 CITY	06 STATE	07 ZIP CODE
Wilmington	MA	01887

III. OFF-SITE GENERATOR(S)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE	05 CITY	06 STATE	07 ZIP CODE

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE	05 CITY	06 STATE	07 ZIP CODE

IV. TRANSPORTER(S)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE	05 CITY	06 STATE	07 ZIP CODE

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE	05 CITY	06 STATE	07 ZIP CODE

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

DEQE File Documents, Woburn Office
Ecology and Environment, Inc., Dec. 1980, Field Investigations of Uncontrolled Hazardous Wastes Sites.
Site inspection report of Olin Chemical, Wilmington, MA

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
MA	D001403104

II. PAST RESPONSE ACTIVITIES

01 ☐ A. WATER SUPPLY CLOSED 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ B. TEMPORARY WATER SUPPLY PROVIDED 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ C. PERMANENT WATER SUPPLY PROVIDED 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ D. SPILLED MATERIAL REMOVED 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ E. CONTAMINATED SOIL REMOVED 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ F. WASTE REPACKAGED 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ G. WASTE DISPOSED ELSEWHERE 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☒ H. ON SITE BURIAL 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION
Calcium hydroxide sludge is landfilled on-site.

01 ☐ I. IN SITU CHEMICAL TREATMENT 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ J. IN SITU BIOLOGICAL TREATMENT 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ K. IN SITU PHYSICAL TREATMENT 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ L. ENCAPSULATION 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ M. EMERGENCY WASTE TREATMENT 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ N. CUTOFF WALLS 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ O. EMERGENCY DIKING/SURFACE WATER DIVERSION 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ P. CUTOFF TRENCHES/SUMP 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ Q. SUBSURFACE CUTOFF WALL 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
MA	D001403104

II PAST RESPONSE ACTIVITIES (Continued)

01 ☐ R. BARRIER WALLS CONSTRUCTED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ S. CAPPING/COVERING — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ T. BULK TANKAGE REPAIRED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ U. GROUT CURTAIN CONSTRUCTED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ V. BOTTOM SEALED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ W. GAS CONTROL — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ X. FIRE CONTROL — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ Y. LEACHATE TREATMENT — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☒ Z. AREA EVACUATED — 02 DATE Nov. 18, 1985 03 AGENCY ______
04 DESCRIPTION Malfunction of a stack scrubber resulted in release of hydrogen chloride gas. Area downwind of site was evacuated by order of Horad of Health and fire Department.

01 ☐ 1. ACCESS TO SITE RESTRICTED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ 2. POPULATION RELOCATED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☒ 3. OTHER REMEDIAL ACTIVITIES — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

Groundwater treatment facility installed in an area of a reported spill by previous owner.

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

DEQE, File Documents, Woburn Office

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 11 - ENFORCEMENT INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
MA	D001403104

II. ENFORCEMENT INFORMATION

01 PAST REGULATORY/ENFORCEMENT ACTION ☐ YES ☐ NO

02 DESCRIPTION OF FEDERAL, STATE, LOCAL REGULATORY/ENFORCEMENT ACTION

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

REFERENCE 2

FINAL VERSION

2

Special Study Report

HYDROGEOLOGIC INVESTIGATION

For
Olin Chemicals Group
Wilmington, Massachusetts

February, 1982

MALCOLM PIRNIE, INC.
CONSULTING ENVIRONMENTAL ENGINEERS

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

February 25, 1982

Mr. David Vaughn
Olin Chemicals Group
Environmental Affairs
Lower River Road
P.O. Box 248
Charleston, Tennessee 37310

Re: Olin Contract No. CS-WI-0000-01618
Hydrogeologic Investigation
Wilmington, Massachusetts

Dear Mr. Vaughn:

In accordance with the subject contract we are pleased to submit a final draft of our special study report entitled "Hydrogeologic Investigation" for the Wilmington plant.

The investigations indicate that the ground water and surface water regimes at the plant are complex. Also concentrations of inorganic and organic materials in the groundwater and surface water are quite variable.

Overall it appears that only the [redacted] to a lesser extent, [redacted]

Major source areas for these materials have been identified. A phased remediation program has been recommended for your review. The program identifies expeditious remedial actions already taken by Olin during this investigation, recommends further actions and outlines a monitoring program.

If you have any questions or require additional information, please do not hesitate to contact us.

Very truly yours,

MALCOLM PIRNIE, INC.

Richard P. Brownell, P.E.
Vice President

Steven P. Maslansky, C.P.G.

RPB:hkh
enclosure

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

1. The purpose of this report is to discuss the results of a hydrogeological investigation of the Wilmington site performed by Malcolm Pirnie, Inc. (Pirnie). The extent and movement of material in ground water and surface water will be discussed and a plan of remediation will be outlined.

2. The Olin site is underlain by crystalline bedrock of Precambrian to Carboniferous and possibly to Triassic age, Pleistocene glacial material, and Recent organic and man-made fill material.

3. The ground-water hydrology is governed to a large extent by the topography and the bedrock contours. The regional [redacted]. In addition to recharge through the unsaturated zone, other sources of water for the ground water are the streams and the small pond, as well as man-made (cultural) contributions.

4. Ground-water discharge from the site is considered to be essentially constant. Overall it is indicated that between 71,000 gpd (April data) and 88,000 gpd (August data) was discharged from the site. Both of these estimates include discharge of water from the sludge lagoons (estimated at 8,000 to 10,000 gpd) and sewers and sumps (perhaps 2,000 to 4,000 gpd).

5. The net surface water discharge was measured to range between 0.21 and 0.32 mgd with a typical value of 0.22 mgd (81 MG per year). This is in the same range as the calculated total discharge estimated from ground-water flow and runoff.

6. On the basis of the contours of specific conductance, there appear to be [redacted] From these two source areas, [redacted]ut with a localized discharge from the southwest of the lagoon area. There appears to be dispersion of the materials with migration.

7. A water budget analysis was used to determine that the [redacted] Lagoon 2 was not yet analyzed.

8. [redacted]

9. During typical conditions in April (several days after a rain event), total site ground-water discharges were approximately 480 lbs/day of chloride, 2,065 lbs/day of sulfate, and 185 lbs/day of ammonia, as shown in Table IV-7. At the same time the total net load emitted from the site as gauged at SS-16 and SS-5 was 535 lbs/day of chloride, 930 lbs/day of sulfate, and 350 lbs/day of ammonia.

10. [redacted] A secondary source is the area around the storage tanks and may be related to the leaking sewer repaired earlier in 1981. Ammonia moves along the predominant routes of ground-water flow. Volatiles (with concentrations above 0.05 mg/l) in the ground-water regime are bromoform, 1,2 dichloroethane, toluene, and methylene chloride. It appears that volatile concentrations in ground water drop off significantly a fairly short distance away from the areas of concentrations above 0.2 mg/l (storage tanks and lagoons).

11. Priority pollutant Volatiles were detected in the East Ditch with the highest concentrations entering the site at station SS-1 on the northern boundary of the site.

12. [redacted]

13. In regard to priority pollutant base/neutrals, roughly 0.1 to 2.5 lbs/day of DOP were calculated to be emitted from the ground water, while 0.15 to 5.0 lbs/day were measured leaving the site. A typical value appeared to have been 0.4 lbs/day. In regard to N-nitrosodiphenyl-amine a typical value leaving the site during the study appears to have been 0.01 lbs/day (as N-nitrosodiphenylamine).

14. There were no non-priority pollutant base/neutrals above detection limits. The only non-priority pollutant volatile that was detected was acetone, at 0.05 to 0.2 mg/l. The source was unkown.

15. [redacted] All other inorganic and organic priority pollutants studied appear to be of no concern.

16. Of the inorganic and organic materials of possible concern discussed above, ammonia is considered to be of somewhat greater concern than the organics. It does not appear that even typical net chloride and sulfate discharges represent a significant water quality problem.

    The first phase of any remedial measures program should address reductions of ammonia. Reductions of chlorides and sulfates also are of some interest and are expected to be related to reductions in ammonia. The second phase of the program should address reductions in priority pollutant organics. The third phase would include monitoring to quantify the improvements obtained by earlier phases.

17. The lagoons are the most crucial area for application of remedial measures for ammonia. As discussed earlier, the lagoons are believed to be the largest single source of ammonia. They also are a major source of sulfate and chloride, and a minor source of a few organics. The primary remedial measure in the lagoon area is excavation of sludge and replacing the liners with a more secure liner system. These remedial measures have been completed for Lagoon 1.

18. Discharge of both organic and inorganic chemicals from the site, especially into the East Ditch, can be decreased by remedial measures in the storage tank area.

19. In order to obtain immediate reductions in contamination of water near the storage tanks, recovery well pumping has been initiated, and should be continued.

20. Considering the nature of the organics being discharged and all other factors, it was recommended that either a multiple recovery well system or an interception ditch be implemented. The multiple recovery well system has been implemented.

21. Because contaminants which have accumulated in and on the banks of the East ditch represent a substantial source of contaminants which may be readily transported off the site by stream flow, removal of this material is deemed an essential remedial measure.

22. The measures proposed above should reduce the discharge of materials from the Olin site. However, further monitoring of the ground and surface water should be done to document the efficiency of the remedial measures implemented and to determine if any further action appears warranted.

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I. PURPOSE OF REPORT

The purpose of this report is to discuss the results of a hydrogeological investigation of the Wilmington site performed by Malcolm Pirnie, Inc. (Pirnie). The extent and movement of material in ground water and surface water will be discussed and a plan of remediation will be outlined.

II. GENERAL SITE DESCRIPTION

Location

The Olin site is located in Wilmington, Massachusetts, shown on the USGS Wilmington Quadrangle map (7½ minutes) at approximately 42° 32' N. latitude and 71° 10' E. longitude. Figure II-1 shows the plant location. The site is approximately 49 acres and is bounded on the north by Eames Street, on the east and the west by the MBTA railroad tracks and to the south by the Wilmington-Woburn town line, beyond which lies the Woburn town refuse disposal area. The plant facilities are located in the northern part of the site and two lined sludge lagoons occupy the central portion; the southern half is wooded. Drainage ditches bound the site on the eastern and western edges; a third drainage complex bisects the site running west to east. Surrounding this drainage system is a low lying swampy area, with a small pond. The plant is located on a topographically high area which includes some filled area. The southern end of the site is also a topographic high. The plant landfill area for the calcium sulfate sludge is located on or near the southern boundary of the site.

Upstream to the north from the Olin site are several manufacturing plants. To the east of the MBTA railroad tracks is a drum reclaiming company. To the west is a roofing manufacturer and another chemical company. Also to the west is substantial tract of land (47 acres) which drains into the complex bisecting the Olin site from west to east.

Geology

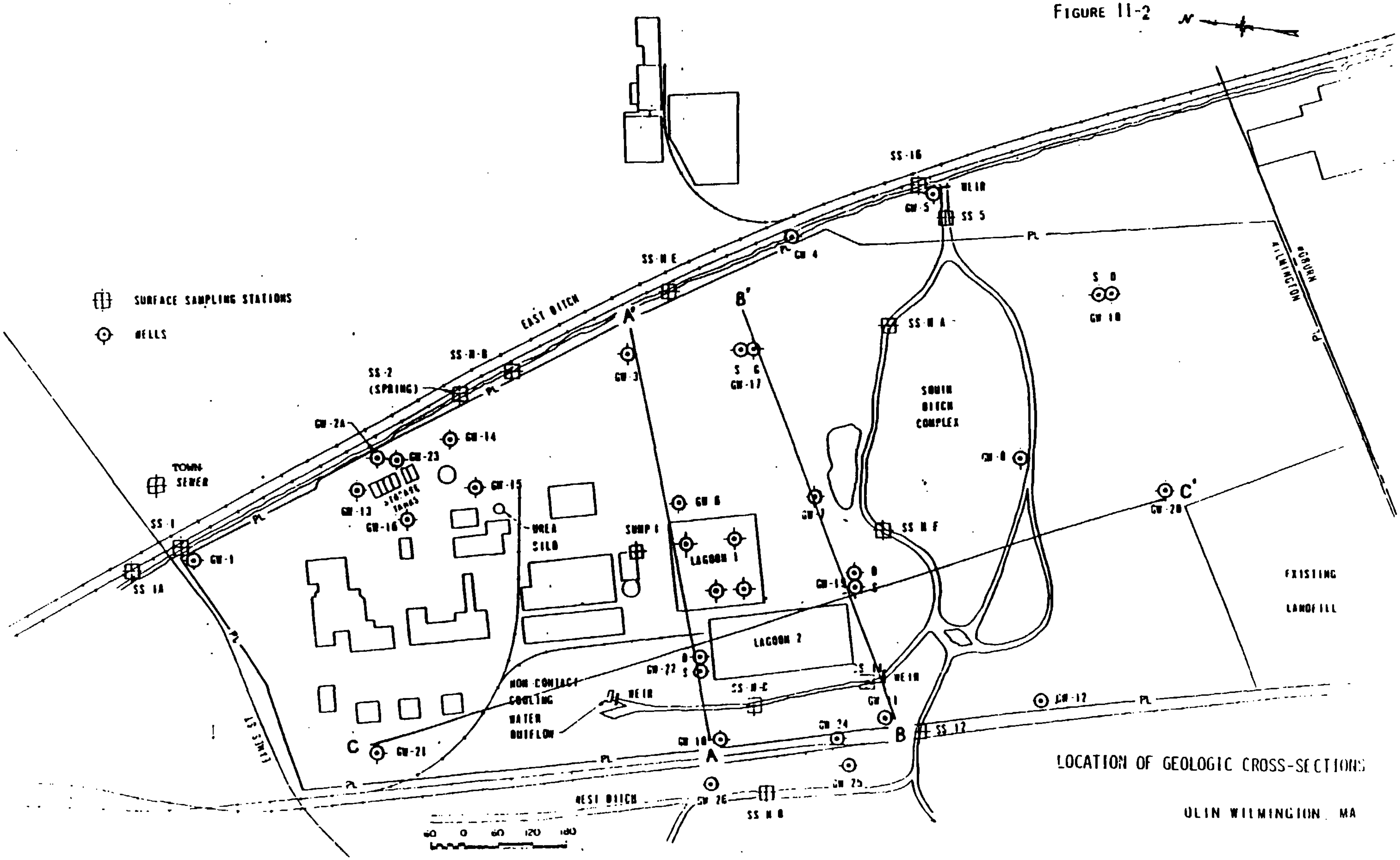
The Olin site is underlain by crystalline bedrock of Precambrian to Carboniferous and possibly to Triassic age, Pleistocene glacial material, and Recent organic and man-made fill material. Figures II-2 through II-5 illustrate the geology of the site. The bedrock consists of gneissic rock

FIGUR

LOCATION OF WILMINGTON PL

IALCOLM PIRNIE, INC.

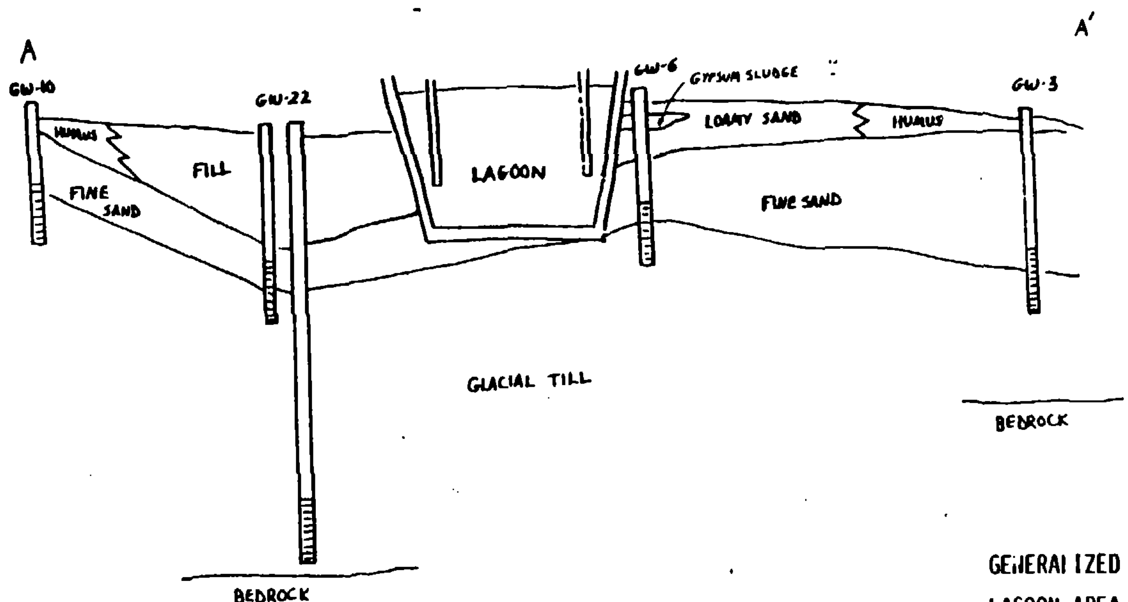
FIGURE II-2



LOCATION OF GEOLOGIC CROSS-SECTIONS

OLIN WILMINGTON, MA

FIGURE 11-3



GENERALIZED EAST-WEST CROSS-SECTION SHOWING LAGOON AREA, A-A'

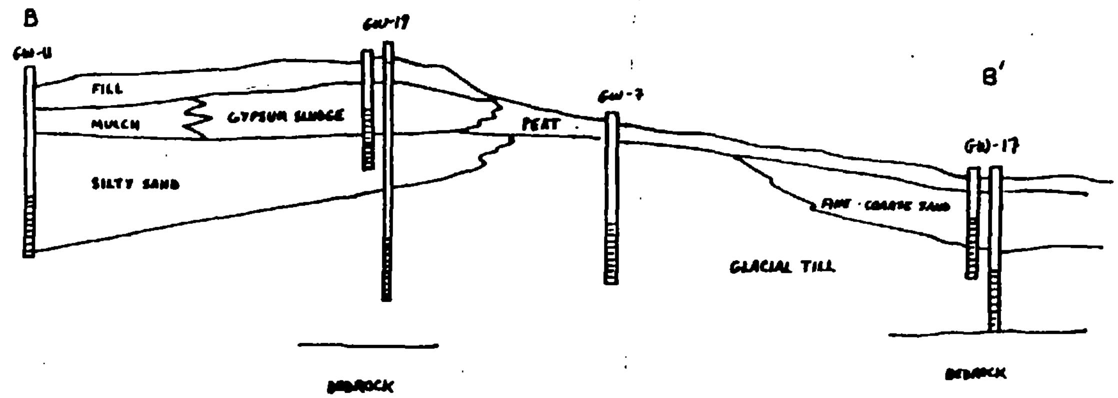
SCALES

HORIZONTAL: 1 INCH = 100 FEET

VERTICAL: 1 INCH = 10 FEET

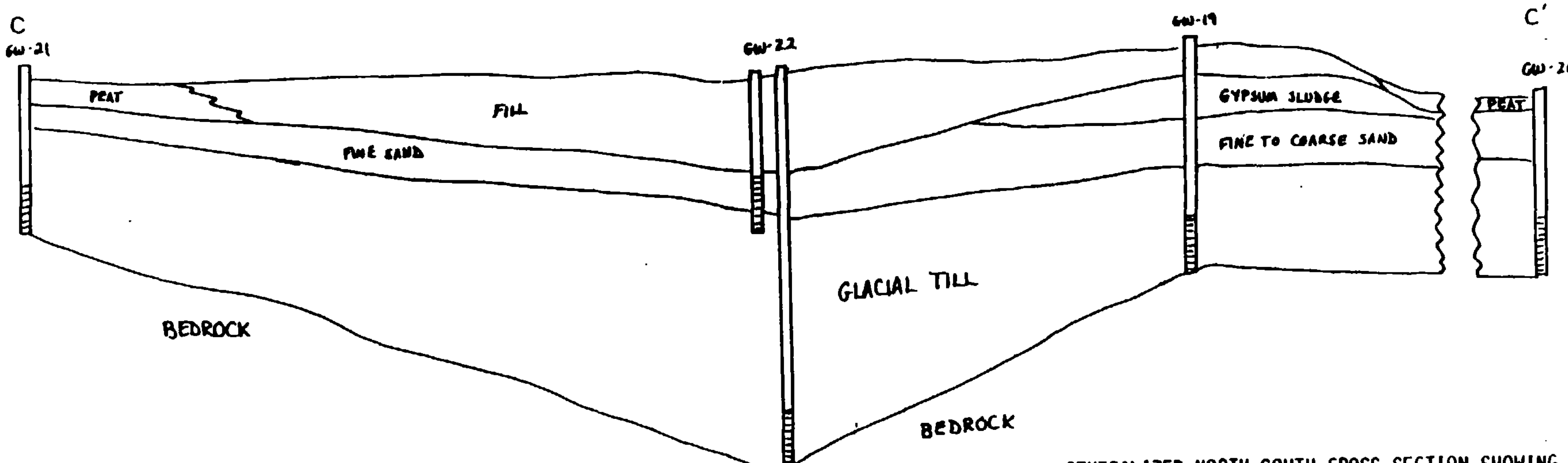
OLIN-WILMINGTON, MA.

FIGURE 11-4



GENERALIZED EAST-WEST CROSS-SECTION
SHOWING SUBSURFACE GEOLOGY, B-B'
SCALE
HORIZONTAL: 1 INCH = 100 FEET
VERTICAL: 1 INCH = 10 FEET
OLIN-WILMINGTON, MA.

FIGURE II-5



GENERALIZED NORTH-SOUTH CROSS-SECTION SHOWING
SUBSURFACE GEOLOGY, C-C'

SCALE

HORIZONTAL: 1 INCH = 100 FEET

VERTICAL: 1 INCH = 10 FEET

OLIN-WILMINGTON, MA.

with abundant quartz-infilled fractures. Outcrops occur in the northwest and southwest corners of the site and along the banks of the eastern drainage ditch. The outcrops appear to be somewhat fractured, with steeply dipping fracture planes. However, the borings conducted as part of this study showed the subsurface rock to be less fractured. (Boring procedures will be discussed in the next section). The borings also indicated the existence of a bedrock valley, possibly bisecting the site from the east to the west, in the central portion of the site. This bedrock valley appears to dip towards the west. Figure II-6 shows the bedrock contours.

The glacial material consists of unconsolidated material that can be divided into two subunits: till and outwash material.

The till overlies the gneissic bedrock and consists of unstratified, poorly sorted sands, silts and gravel with some large cobbles and boulders. Till is deposited by and directly under a glacier and is not reworked by meltwater streams.

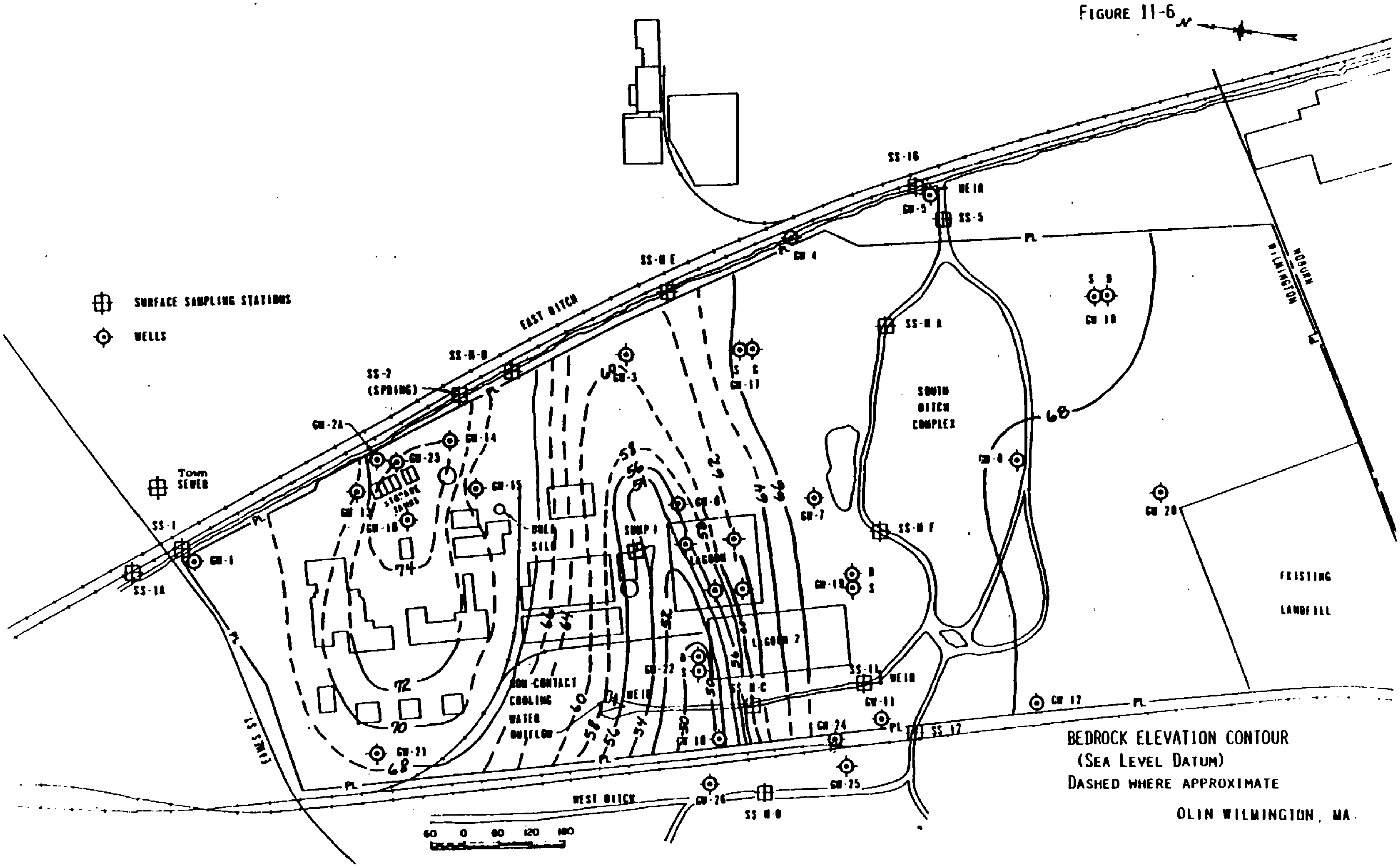
The outwash material overlies the till and is made of well to poorly graded sands and silts, with traces of gravel and clay. Outwash material is deposited at the edge of a melting glacier by meltwater streams.

The Recent surface organic layer overlies the outwash material, primarily in the low-lying areas of the site.

Local Hydrology

Surface water flow is controlled by the three major ditch systems: the East Ditch, the West Ditch and the South Ditch complex. (Please note that ditch designations used in this report differ from designations by others in earlier reports.) The East Ditch flows along the length of the site and contains water year-round due to flow from upstream. The only influent stream to the East Ditch is the South Ditch. The East Ditch also contains a spring (SS-2) which emanates from the stream

FIGURE II-6



BEDROCK ELEVATION CONTOUR
(SEA LEVEL DATUM)
DASHED WHERE APPROXIMATE

OLIN WILMINGTON, MA

bed. The fluid is golden-brown and appears to be emanating from the stream bed at a faster rate than the stream flow. The West Ditch also flows along the western boundary, turns east and becomes the beginning of the South Ditch. There are several small ephemeral influent streams from the western side of this ditch. The West Ditch becomes almost completely dry during the dry season. The South Ditch complex is actually a series of streams in a lowlying swampy area. In addition to the West Ditch, a source of water into the South Ditch is an intermittent non-contact cooling water outflow ditch which flows between the sludge lagoon and the western MBTA track. The South Ditch system becomes almost completely dry during the dry season. A small intermittent pond is also part of the South Ditch drainage system.

The ground-water hydrology is governed to a large extent by the topography and the bedrock contours. The regional ground-water flow is generally towards the southeast and occurs mainly in the glacial material. In addition to recharge through the unsaturated zone, other sources of water for the ground water are the streams and the small pond, as well as man-made contributions. This subject will be discussed in greater detail in Chapter IV.

III. INVESTIGATORY PROGRAM

Previous Investigations

In 1978, Geotechnical Engineers, Inc. (GEI) was contracted to undertake a ground-and surface-water study of the plant area by the Massachusetts Department of Environmental Quality Engineering. Twelve soil borings were performed and eleven monitoring wells were installed around the site to determine subsurface conditions. Ground-and surface-water samples were analyzed for selected organic and inorganic parameters.

In 1980, New England Pollution Control Company, Inc. (NEPCO) was requested by Olin to investigate the area on the eastern boundary of the site where black material was discharging out of the east bank. Eleven soil borings were made and five observation wells were installed. Samples of the black material were analyzed and ground-water measurements were made to determine direction of flow.

Present Investigation

This study program conducted by Pirnie over a one-year period during 1981 included both field and laboratory investigations and observations. The year was divided into four quarterly investigation periods. During the second quarter, the program was further split into three monthly investigation periods. The field work was performed by Pirnie personnel. The laboratory work was performed by the Pirnie laboratory in White Plains, New York and by Mead/CompuChem, Incorporated (CompuChem) in Research Triangle Park, North Carolina.

Field Work

The field investigation at the Olin site consisted of investigation of the geological material, the surface and ground water and the pertinent treatment and disposal facilities.

The geological material was investigated through two methods. Soil borings were performed and continuous soil samples were taken in order to determine characteristics of the subsurface material through laboratory analysis of moisture content, pH, cation exchange capacity and sieve-hydrometer grain-size distribution. Test pits were dug to further investigate the subsurface. Monitoring wells were also installed to investigate ground-water conditions.

Investigation of the surface-and ground-water conditions at the Olin site includes water level and flow measurements, field physiochemical analysis and water sampling, a total of 29 ground-water and 14 surface water sampling stations. Three samples each were also taken from the sewer system and the lagoons in order to define sources of contamination. Table III-1 lists the total sampling stations. Figure III-1 shows their locations.

o <u>Soil Boring and Monitoring Well Installation</u>. When Pirnie started investigations at the Wilmington site, there were 16 pre-existing monitoring wells on-site. In order to provide a more comprehensive sampling grid and obtain more information on the subsurface, six new well sites were constructed with a total of ten new monitoring wells. Four of these six well areas consist of a nested well system, which contain two monitoring wells (one shallow and one deep) located next to each other. A large-diameter well was also constructed near the northeast storage tanks for general observation. Well GW-2, after being destroyed by a backhoe, was replaced before the August sampling period. The new well was designated GW-2A. An additional monitoring well, GW-23, was installed near the storage tanks at the same time. Three drive-point monitoring wells, GW-24, GW-25, and GW-26, were also installed near the west ditch before the August sampling.

TABLE III - 1

SAMPLING STATIONS - OLIN - WILIMINGTON

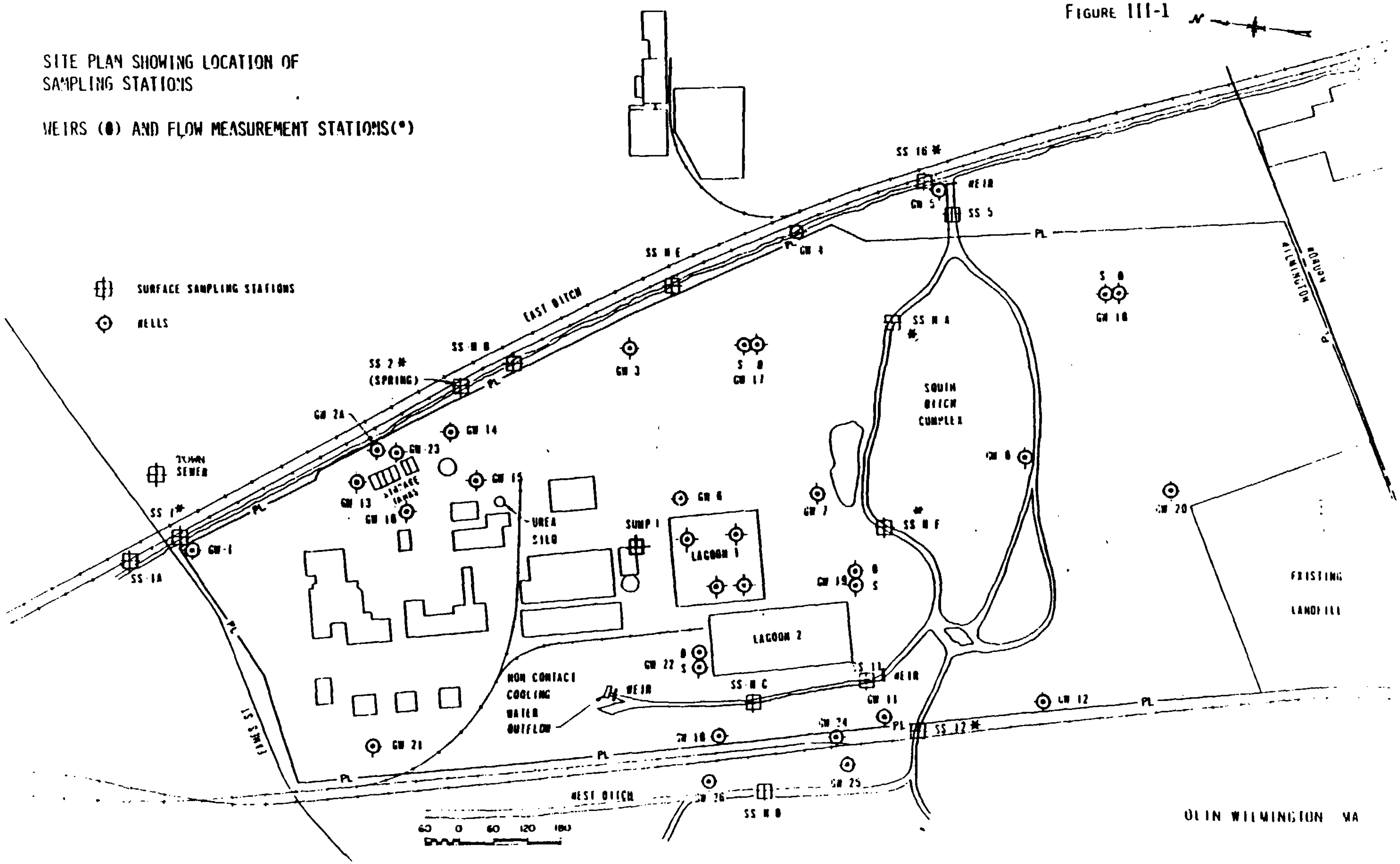
Ground Water	Surface Water	Sewer	Lagoons
GW-1	SS-1	SUMP 1	LAGOON 1(SOLID)
GW-2 + 2A	SS-1A	TOWN SEWER	LAGOON 1(LIQUID)
GW-3	SS-2(SPRING)	PLANT SEWER	LAGOON 2(LIQUID)
GW-4	SS-5		
GW-5	SS-11		
GW-6	SS-12		
GW-7	SS-16		
GW-8	SS-N-A		
GW-10	SS-N-B		
GW-11	SS-N-C		
GW-12	SS-N-D		
GW-13	SS-N-E		
GW-14	SS-N-F		
GW-15	SS-N-G		
GW-16			
GW-17S*			
GW-17D**			
GW-18S			
GW-18D			
GW-19S			
GW-19D			
GW-20			
GW-21			
GW-22S			
GW-22D			
GW-23			
GW-24			
GW-25			
GW-26			
Recovery Well - 1			

* S = Shallow
** D = Deep

FIGURE III-1

SITE PLAN SHOWING LOCATION OF SAMPLING STATIONS

WEIRS (●) AND FLOW MEASUREMENT STATIONS(*)



o Test Pits. Test pits were dug in March 1981 and August 1981 around the northeast storage tanks to further assess the subsurface material, to install a recovery well, and specifically to delineate the extent of contaminant movement around the tank area. The test pits were dug using a backhoe provided by George Gately, of Wilmington, Massachusetts. Two test pits were dug in March, 1981. Four test pits were excavated during the August, 1981 period.

o Water Measurements. Ground-water level measurements were taken at each investigation period during the four quarters, totalling six measurements for the year. The measurements were taken using a drop light. Ground water elevations were then calculated, and potentiometric maps of the ground-water table were drawn.

Surface-water flow velocity measurements were made either with a Marsh-McBirney flow meter or a weir. Cross-sectional measurements of the stream were taken at each flow measurement station in order to calculate stream discharges. Two weirs were contructed by Pirnie personnel in order to measure stream flow more precisely. One weir was constructed in the South Ditch near its confluence with the East Ditch. The other weir was built downstream of the non-contact cooling water effluent pipe. Figure III-1 shows the location of the weirs and flow measurement stations.

o Physiochemical Measurements. The field physiochemical measurements made were pH, temperature, specific conductance and dissolved oxygen (D.O.). Table III-2 shows the schedule of measurements. Measuring techniques and types of equipment used are listed in Appendix A.

These field physiochemical measurements (except the D.O.) were performed at the major surface and ground-water sampling stations, (designated SS and GW, respectively) for all of the sampling periods. The D.O. was taken during one sampling period only, to ascertain whether the geochemical system was operating under aerobic or anaerobic conditions.

o Well and Surface Water Sampling Techniques. Sampling was performed using two methods, a PVC bailer for the ground-water samples and by dipping the sample bottles to obtain surface water samples. The order of sampling was from less contaminated to more contaminated stations, in order to lessen any possibility of cross-contamination of samples.

To obtain the ground-water samples, the total volume of the wells was evacuated three times before sampling, with a 1½-inch PVC bailer. Samples were also obtained by use of the bailer. For sampling volatiles care was taken not to agitate the ground water while sampling. The bailer was rinsed with distilled water after each well sampling was completed. The bailer was rinsed with acetone, then distilled water after sampling wells with high levels of organic contaminants.

Surface water sampling was performed by dipping the sample bottle below the stream surface, in order to obtain a more representative sample from the stream flow.

o Lagoon Monitoring. The two sludge lagoons were also monitored through sampling and water level measurements. In order to monitor Lagoon 1, the smaller 195 ft. by 195 ft. lagoon, four one-inch diameter well points were installed in the lagoon. Water levels were taken during the first, second and third quarters, for a total of five measurements. Reconstruction of the lagoon prevented measurements from being taken in the fourth quarter. The water levels were used to calculate a water balance for the lagoon, described in a later portion of this report. One sample each of the Lagoon 1 liquid and solids, and the Lagoon 2 (260 ft x 85 ft) liquid was taken in the third quarter. Field pH measurements were taken in each of the three quarters.

Laboratory Soil Tests

Laboratory tests were performed in the Pirnie soils laboratory on selected soil samples from the borings. The laboratory tests performed included moisture content, cation exchange capacity (CEC), sieve-hydrometer grain-size distribution analysis, and pH measurements. These tests were performed according to the procedures and methods listed in Appendix B.

Laboratory Chemical Analysis

Water samples were analyzed for selected inorganic constituents, Priority Pollutant volatile and base/neutral constituents and non-Priority Pollutant organic constituents during the course of the year. Table III-2 shows the schedule of analysis for the chemical constituents.

The analyses of the inorganic constituents and selected volatile Priority Pollutants during certain sampling periods was performed by Pirnie. The analysis of the majority of the volatile and base/neutral Priority Pollutant constituents as well as the non-Priority Pollutant constituents was performed by CompuChem.

The techniques used for the analysis of the inorganic constituents are listed in Appendix C. The techniques used for the organic analysis are listed in Appendix E.

TABLE III - 2

Constituent	1st Qtr. 3-81	2nd Qtr. 4-81	5-81	6-81	3rd Qtr. 8-81	4th Qtr. 12-81
Field						
1. pH	*	*	*	*	*	*
2. Specific Conductance	*	*	*	*	*	*
3. Temperature	*	*	*	*	*	*
4. Dissolved Oxygen		*	*	*		
Laboratory						
1. Chlorides	*	*	*	*	*	*
2. Sulfates	*	*	*	*	*	*
3. Ammonia	*	*	*	*	*	*
4. Nitrate-Nitrite	*	*	*	*	*	*
5. Alkalinity	*	*	*	*		*
6. Metals:						
Lead	*	*	*	*	*	*
Chromium Total	*	*	*	*	*	*
Cr^{+3}, Cr^{+6}		*	*	*	*	*
Cadmium	*	*	*	*	*	*
7. Volatile Priority Pollutants	*		*		*	*
8. Base-Neutral Priority Pollutants	*		*		*	*
9. Non-priority Pollutants						
dioctyldiphenylamine	*					
20 peak search			*		*	

CHAPTER IV
DATA EVALUATION

General

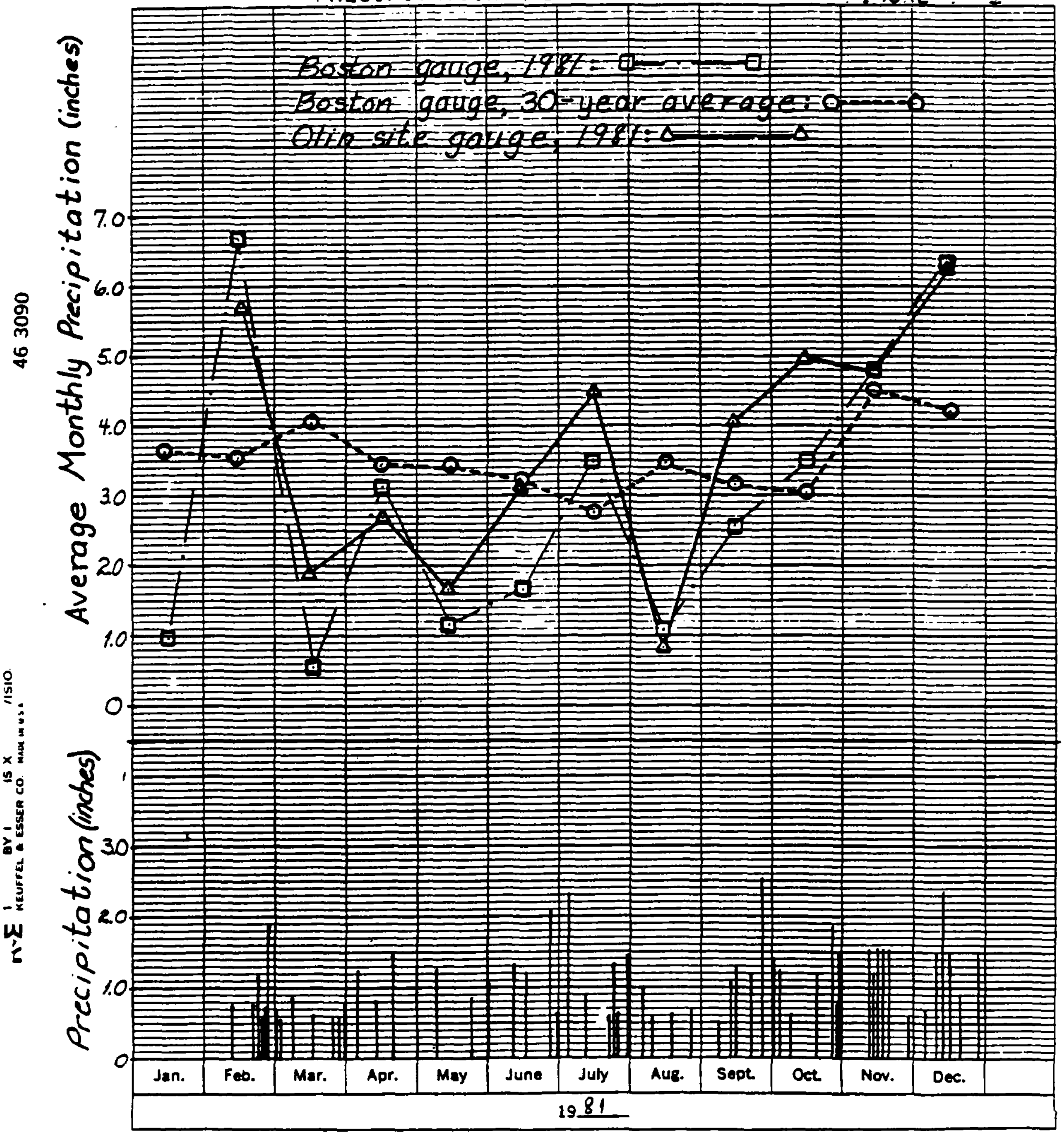
As discussed in previous sections, an extensive field and laboratory investigatory program was undertaken to determine the extent of materials on the Olin site and the movement of materials onto and off the site. To accomplish this objective, field information was collected to quantify precipitation and ground-water and surface water flows to and from the site. Consideration was given to both naturally and culturally induced water flows and also to the possibility of seasonal differences.

The water balance information was then to be interfaced with data on inorganic and organic materials in the ground and surface waters. It was expected that approximate material balances could be obtained on materials of interest. This in turn would facilitate the evaluation of any appropriate remedial measures.

As a first step, a comparison was made of total monthly precipitation measured with the gauge at the Olin site, the gauge in Boston, and the thirty-year average total monthly precipitation measured. Figure IV-1 indicates that 1981 was a slightly below average water year. The total annual precipitation based on the thirty-year average data was 40.5 inches per year versus about 37 inches per year in 1981 at Olin. Figure IV-1 also indicates that March, November and December historically are high rainfall months while July is the lowest. March also was considered by Pirnie to be a historically possible high surface water month, as a result of snow melt. However, the Olin site received subnormal precipitation in March (normally wet). Data from the Boston station also indicates that January was a dry month while February received higher-than-average rainfall. While July was wetter than

PRECIPITATION HYDROGRAPH

FIGURE IV-1



MALCOLM PIRNIE

normal, August was a very dry month. While the thirty-year average data indicate that there is a mild seasonality in precipitation in the area, the 1981 data from both the Boston and the Olin gauges indicate that specific precipitation events can completely mask the mild, long-term trends.

The ground-water system will generally have a slow response time to additions of precipitation (weeks to several months) but will generally reflect cumulative precipitation events over the last several months. Surface water responds to precipitation events in a shorter time (several hours to 36 hours); hence the surface runoff measurements made at a point in time on the Olin site also reflect a response to recent discrete precipitation events. The differences in response times between these two systems complicates interpretation of surface and ground-water data at this site. Overall the precipitation data indicate that there are no seasons of significance, only dry and wet periods of varying time duration. Consideration will be given to using average annual discharges where appropriate. Ground-water and surface water discharge data are discussed below with this in mind.

Ground-Water Flows

Hydraulic Conductivity

As discussed earlier, there are two principal subunits in the unconsolidated sediments underlying the site: the sand and the glacial till. These have differences in their hydrogeologic properties which are discernible by both field descriptions and laboratory investigations.

Field descriptions from borings completed on the site delineated the thickness and areal extent of the two soil subunits. Grain size analysis by sieve and hydrometer methods were performed to verify field descriptions and to determine the hydraulic conductivities of the soils underlying the Olin site. Laboratory estimates of hydraulic conductivity varied from 34 ft/day ($1.2x10^{-2}$ cm/sec) to 0.2 ft/day ($7.2x10^{-5}$ cm/sec). These values were in the same range (57 ft/day ($2x10^{-2}$ cm/sec) to 0.3 ft/day ($1x10^{-4}$ cm/sec) as those determined by Geotechnical Engineers Incorporated (GEI) by in-situ falling head tests in wells set in the soils in the Olin site. A table in Appendix B summarizes the measured hydraulic conductivities which vary both between and within soil types. However, the site soils are quite variable. This complexity makes it extremely difficult to estimate ground-water flows except in using average hydraulic conductivity for the site. An average of 17 ft/day ($6x10^{-3}$ cm/sec) was used to calculate discharge.

Ground-Water Table

The water levels measured in the monitoring wells were expected to be useful for two purposes: identification of recharge and discharge areas; and, the estimation of overall ground-water flow velocities and flows. To develop the overall ground-water flows, well water levels observed during all six field trips were reviewed. Water contour maps were drawn for April and August (Figures IV-2 and IV-3).

Nested wells assisted in differentiating recharge zones (where head in the shallow well is greater than head in the deep well) from discharge zones (where head in the shallow well is less than head in the deep well). The area near GW-19 (between the lagoons and the South Ditch complex) is a ground-water discharge zone at all sampling times while the areas around the other nested wells were ground-water recharge zones. The upward flow of ground water in the area around GW-19 signifies two things: first, all of the ground water discharged from the site toward the South Ditch complex should discharge into the Ditch (i.e., ground water does not bypass the Ditch by flowing under the Ditch), second, symmetrical discharge of ground water from the soils south of the South

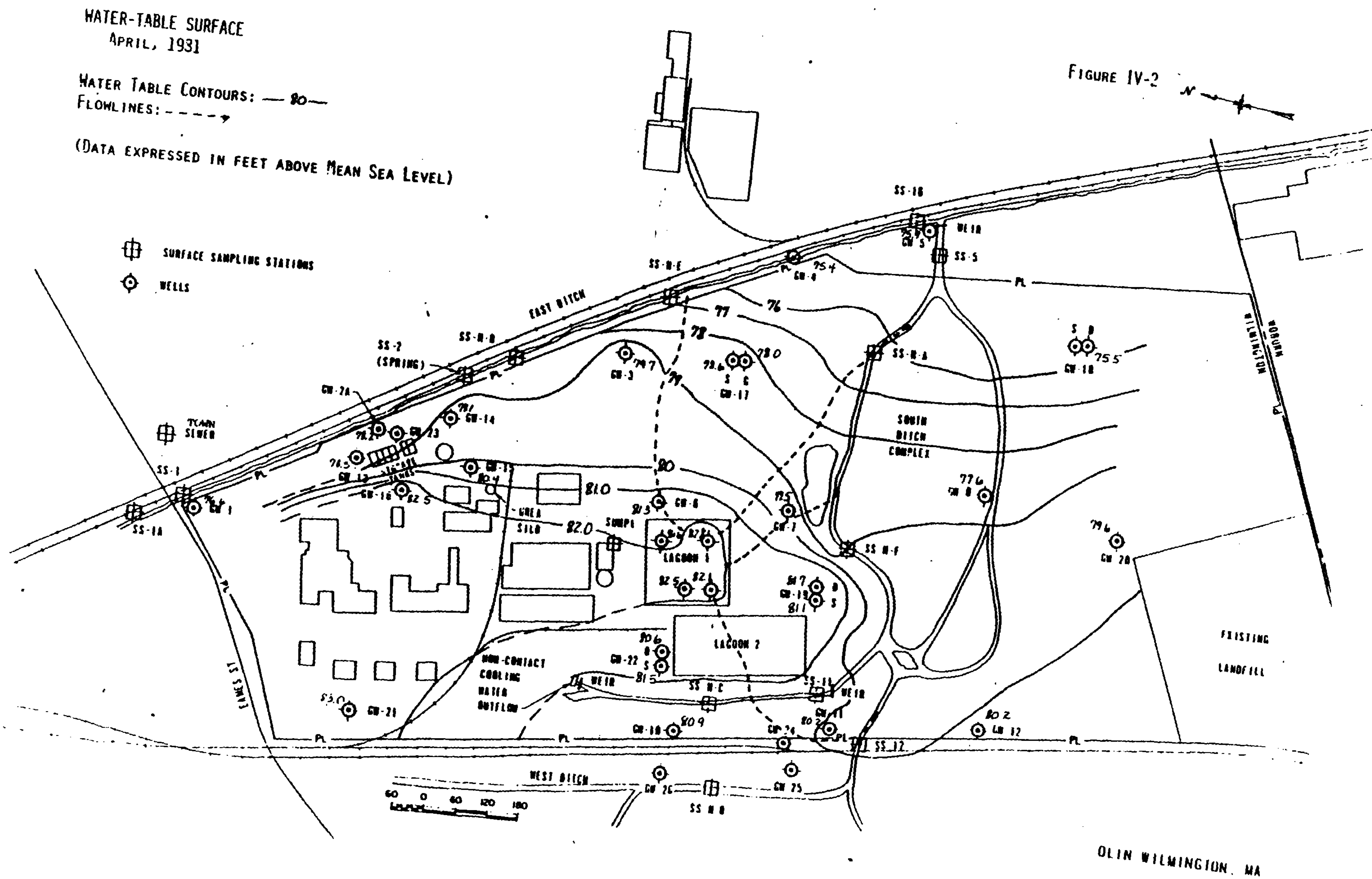

WATER-TABLE SURFACE
APRIL, 1931
WATER TABLE CONTOURS: — 80 —
FLOWLINES: - - - - →
(DATA EXPRESSED IN FEET ABOVE MEAN SEA LEVEL)
SURFACE SAMPLING STATIONS
WELLS
EAST DITCH
SOUTH DITCH COMPLEX
LAGOON 1
LAGOON 2
NON-CONTACT COOLING WATER OUTFLOW
UREA SILO
SUMP
WEIR
WEST DITCH
EXISTING LANDFILL
EAMES ST
WILMINGTON WOBURN
TOWN SEWER
SS-1
SS-1A
SS-2 (SPRING)
SS-5
SS-16
SS-12
SS-14
SS N-B
SS N-C
SS N-E
SS-N-A
SS N-F
SS H-D
GW-1
GW-2A
GW-3
GW-4
GW-5
GW-6
GW-7
GW-8
GW-11
GW-12
GW-13
GW-14
GW-15
GW-16
GW-17
GW-18
GW-19
GW-20
GW-21
GW-22
GW-23
GW-24
GW-25
GW-26
PL
76
77
78
79
80
81.0
82.0
60 0 60 120 180
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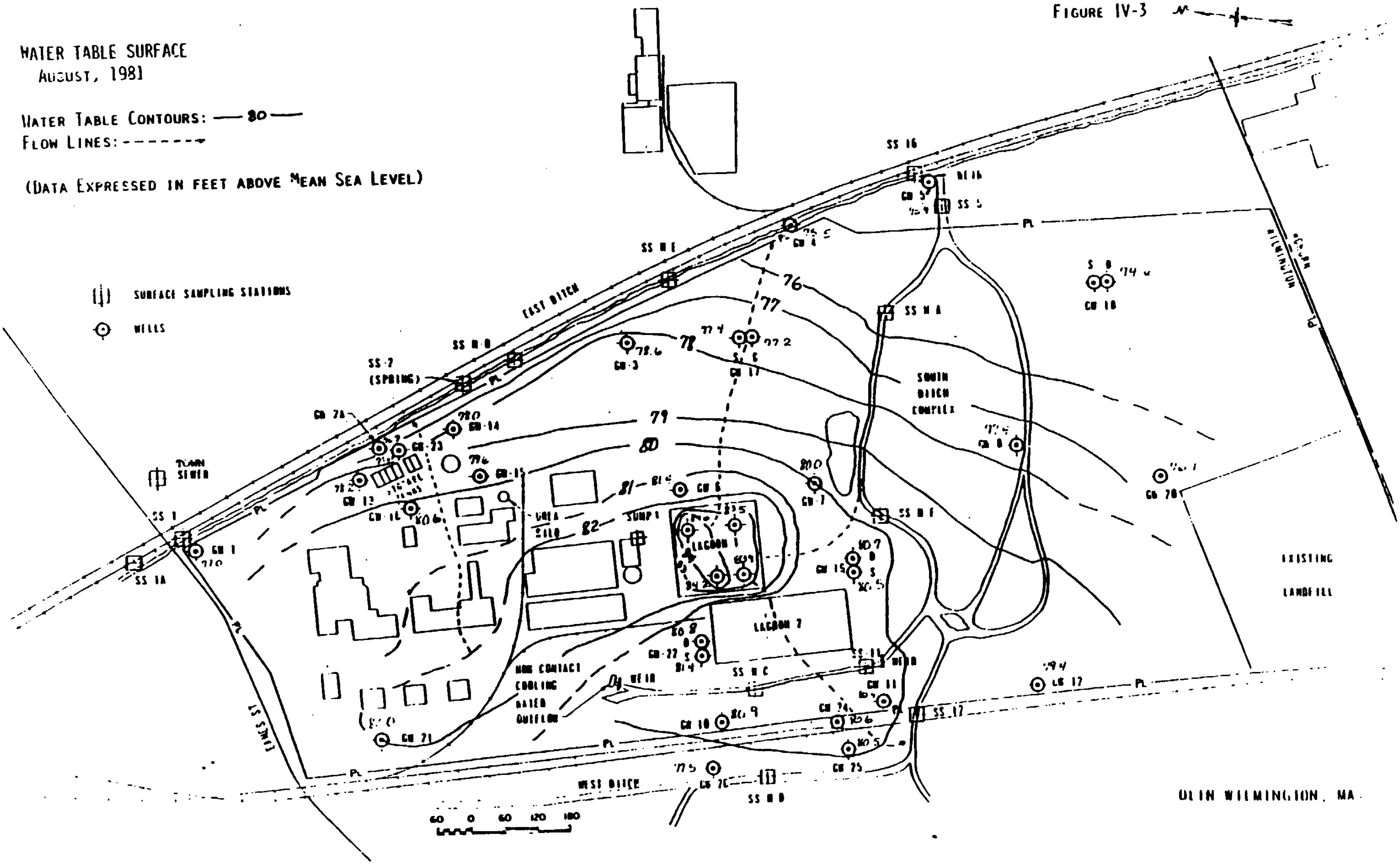
Figure IV-2

Figure IV-3

WATER TABLE SURFACE
August, 1981

Water Table Contours: —— 80 ——
Flow Lines: - - - - - - →

(Data Expressed in feet above Mean Sea Level)



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Ditch complex is a reasonable assumption. The contours shown (graduated in feet above sea level datum) connect points of equal hydrologic head (potential). As indicated by the dashed lines in Figure IV-2, ground-water flow is almost always perpendicular to these contour lines at any one point in time. Therefore, the dashed lines illustrate the direction of ground-water flow on the site. Throughout the Olin site, there is a general south-southeast decrease in elevation of the ground-water table (gradient) which is probably the natural flow direction produced by bedrock configuration and location of recharge areas. A north-south trending ground-water mound is superimposed on this natural gradient in the area which underlies Lagoon 1 and the buildings to the north of Lagoon 1. This mound is probably influenced by man-made inputs. Leakage from the lagoons probably contributes to the south end of the mound. Ground water recharge by roof or foundation drains from the buildings and possibly leakage from sewer lines also represent a minor contribution; however, this was not investigated. It is our understanding that the sewers are being repaired.

Comparison of the ground-water table elevations for April and August indicates that the water-table surface maintains the configuration described above. Comparisons between water levels in individual wells indicate that water levels in wells around the periphery of the site (GW-21, GW-3, GW-8, GW-12) decreased between April and August while water levels in the area around the lagoons and the buildings to the north of the lagoons increased slightly (approximately 0.1 ft) over this same time period. Overall the greatest gradients (difference in water elevation) occurred in August. As noted earlier, August had little rainfall; as will be discussed later, our measured surface water flows were the lowest in August. Stream water levels also should have been the lowest. Conversely, April gradients were representative of the other five measurement events.

Lagoon Water Balance

One concern raised by Olin was whether or not the existing gypsum lagoons were leaking through the liners. Pirnie scientists used a water budget analysis to surmise that the Lagoon 1 (see site map) was leaking and to estimate the volume of water that leaked through the liner of the lagoon. Using precipitation measurements from the rain gauge on-site and the best possible estimates of the volume of water that could be evaporated from the lagoon surface, the expected water levels in the sludge were calculated. These expected water levels were then compared with measured water levels and the rate of discharge from the lagoon was calculated for two different values of sludge porosity (i.e., water stored in voids in the sludge). The total water loss from the lagoon was calculated by multiplying the difference in water levels by the total area of the lagoon. These calculations, summarized in Table IV-1, indicate that between 52,900 gallons and 240,000 gallons of water leaked through the boundaries of Lagoon 1 in approximately a one-month time span depending on the porosity value used. Similar volumes of water are speculated to be leaking from Lagoon 2, since it has received the same sludges and has been operated in the same fashion as Lagoon 1.

TABLE IV-1

CALCULATED WATER LEAKAGE FROM LAGOON 1

Time Span	Porosity	Water Lost (gallons)
March-April	30%	52,900
April-May	30%	218,000
March-April	50%	86,000
April-May	50%	240,000

Excavation of sludge and inspection of the lagoon liner in the fall of 1981 confirmed that the liner was perforated and allowed leakage of fluids from the lagoon. As will be described later, actions were initiated by Olin to replace the liners.

Overall Ground-Water Discharge

Calculations of ground-water flow velocities were based on hydraulic conductivities and gradients. The actual flow velocity through the glacial till, which, in most cases, constitutes a great portion of the saturated thickness of the aquifer, may be as low as 0.3 ft/day ($1x10^{-4}$ cm/sec). The average velocity is believed to be on the order of 0.5 ft/day ($1.7x10^{-4}$ cm/sec). Overall it is indicated that between 71,000 gpd (April data) and 88,000 gpd (August data) was discharged from the site. Both of these estimates include discharge of water from leaky lagoons (estimated at 8,000 to 10,000 gpd) and sewers and sumps (perhaps 2,000 to 4,000 gpd). Under natural conditions, actual ground-water discharge may be on the order of 59,000 gpd. The observed increase in ground-water discharge between April and August is probably produced by the increase in the hydraulic gradient which is observed on the site in August. Given the great variability in hydraulic conductivity of soils on the site (as much as two orders of magnitude) and errors in estimating the hydraulic gradients from water-table contours, ground-water discharge from the site is considered to be essentially constant.

Surface Water Flows

A surface-water monitoring system was established on the site to evaluate the response time of the surface water system to long-term and single-event variations in precipitation and to measure the total discharge from the site. The surface water is derived from runoff and ground-water discharge. The surface water monitoring program included installation of 13 stream gauging stations, including weirs and points where flow velocity measurements were taken. Surface-water sampling stations were chosen so that discharge at the upstream station could be subtracted from discharge at the downstream station to determine the approximate volume of surface water derived from the Olin site. The two weir locations were expected to yield more precise information than the other stations (see Figure IV-3 or Figure III-1 for the location of the measurement points). Table IV-2 summarizes the surface-water discharge measurements made during six sampling field trips to the Olin site.

TABLE IV-2

DISCHARGE RATES OF SURFACE WATER AT THE OLIN SITE
(million gallons per day)

	Mar.	Apr.	May	June	Aug.	Dec.
East Ditch SS-1	0.21	0.09	0.19	0.18	0.17	0.23
East Ditch SS-2	-	-	-	0.03	0.05	0.15
East Ditch SS-16	0.24	0.30	0.36	0.30	0.16	0.39
South Ditch SS-5**	0.18*	0.04	0.03	0.19	0.06	0.13
South Ditch SS-11**	-	-	-	-	-	0.10
South Ditch SS-N-A	-	-	-	-	-	0.30
South Ditch SS-N-F	-	-	-	-	-	0.27
South Ditch SS-12	-	0.10	0.13	0.01***	No Flow	0.05
"Net" Discharge****	0.21	0.25	0.20	0.31	0.05	0.29

* Flows measured prior to weir construction
** Weir
*** Before rain event
**** Sum of SS-16 minus SS-1 plus SS-5

As can be seen from the above table, surface water discharges from the site were highly variable. Net discharges can be calculated for the eastern 15 acre portion of the site (north of the South Ditch complex) contributing to the East Ditch by subtracting the flow at SS-1 from the flow at SS-16. The net increase ranged from about 210,000 gpd in April down to a calculated loss in August. It is believed that these August data represent a measurement error within the accuracy of the measuring device used. Since there was no evidence of recharge from the East Ditch into the site during August, a positive increase in flow almost certainly occurred in actuality.

The net discharge leaving through the South Ditch complex is more difficult to determine; as discussed earlier, some ground water is believed to leave the site to the west and reenter the site at SS-12. This station also receives contributions from the drainage area to the west of the Olin site. However, the net discharge from the South Ditch complex roughly ranges from a 180,000 gpd increase to a 100,000 gpd decrease; the decrease is attributed to storage in the South Ditch complex. This storage is represented by the intermittent pond mentioned previously.

The overall total net discharge through the East Ditch SS-16 and the South Ditch complex for the entire 57 acre site and the 43 acres to the west was as high as about 310,000 gpd. while the low value was measured to be 52,000 gpd, it is believed that a value of 60,000 gpd is probably more accurate. The above flows include cultural inputs.

Comparison of the average annual discharges from the site and the individual measurements collected during the six samplings illustrates how the hydrologic system responds to conditions of above and below normal precipitation. The minimum net discharges from the site were measured in August, the time indicated by the rain gauge to be the prolonged dry condition. Discharge through the South Ditch in August was 0.065 mgd, which is predominantly ground water and non-process cooling water; differences in discharge through the East Ditch are less than the detection limits of the flow meters used. Although June would be expected to be a normal precipitation discharge time period, the net site discharge was at a maximum, 0.32 mgd, and results from a measurement taken a day after a rain event of 1.5 inches in twenty-four hours. This discharge, which is predominantly surface water, illustrates that the maximum discharges from the site are related to discrete high intensity precipitation events. The December measurements were taken under prolonged high precipitation conditions in which both ground and surface water would respond to increased water supply. Therefore, the 0.29 mgd was representative of the maximum discharge that could be anticipated from the site over extended periods of time (weeks or a month).

Water Budget Calculations

Calculation of Typical Surface Water Discharges

Although the water system at the Olin site is too complex to permit water budget analysis of data collected at a single point in time, water budget calculations can be made using average annual data. The geologic, hydrologic, and geochemical information collected indicate that the ground water and surface water flowing from the site and the 47-acre drainage basin to the west discharges into the East Ditch and South Ditch complex and can be measured as discharge through SS-16 and SS-5.

Ground Water from the Olin Site - Water table contours show that the hydraulic gradients and saturated zone thickness remain fairly constant throughout the year. The total groundwater discharge through the site is approximately 71,000 gallons per day or 26 MG/year. This estimate includes man-made contributions: from the lagoons (about 8,000 to 10,000 gpd) and leaky sewers and sump (perhaps 2,000 to 4,000 gpd) so that the natural yield from the site would be on the order of 59,000 gpd or 0.50 MG/year acre.

Ground Water from Off-Site - The South Ditch also receives ground-water discharge from the drainage basin to the south and west of the Olin site. Approximately half (23 acres) of the off-site portion of the drainage basin is not believed to receive significant recharge from precipitation to produce ground water because of suspected low permeability of the soils and recent construction. Therefore, the remaining 24 acres of the drainage basin to the west based on the natural yield rates listed above would be expected to produce ground water at a rate of 0.50 MG/acre-year for a total of 12 MG/year of water from off-site ground-water discharge, based on experience elsewhere.

Runoff - In addition to the ground-water discharge discussed earlier, some of the precipitation which falls on the site leaves as surface runoff. Runoff rates for the general area around the site, as listed in existing literature, is estimated at approximately 12 inches per year for 37 inches of precipitation. At this rate the 100-acre drainage basin in which the Olin site is located produces 33 MG/year as surface runoff.

Total Typical Discharge - The calculations above indicate that approximately 71 MG/year of water is discharged from the site. It is inferred from geologic and hydrologic data in this study that all of this water discharges through the gauging stations at the furthest points downstream on the East Ditch (SS-16) and on the South Ditch (SS-5). For the six data sets the net discharge through these two points was calculated subtracting the discharge at SS-1 from the discharge at SS-16 and summing this with the discharge at SS-5. The net discharge calculated by this method ranged between 0.21 and 0.32 mgd with an average of 0.22 mgd (August data excluded because of anomalous data and non-correlation with average values). This typical flow of 0.22 mgd is approximately 81 MG per year and is in the same range as the calculated total discharge estimated from ground-water flow and runoff. The 81 MG per year typical measurement also includes man-made inputs to both surface and ground water. Table IV-3 summarizes the annual water budget calculations.

TABLE IV-3

ANNUAL WATER BUDGET SUMMARY

		Volume
1.	Estimated Component Contributions	
	Ground water from Olin site	26 MG/Y
	Off-site ground water from infiltration into the remaining 47 acres of the watershed	12 MG/Y
	Runoff from entire 100-acre drainage basin	33 MG/Y
	Total calculated yearly discharge, estimated:	71 MG/Y
2.	Total Typical Measured Discharge	81 MG/Y

Inorganic Material Analyses

A comprehensive program of ground-water and surface water sampling and analysis was conducted to identify materials present in the ground water at the site. Sample point networks and sample schedules were designed to identify the sources of materials, monitor material migration, and permit estimations of the quantities of various materials which discharge from the property.

Ground Water - Inorganic Chemistry. Samples of ground water were collected on six occasions and the concentrations of inorganic chemicals in these waters was measured. Appendix 3 summarizes the results of the inorganic ground-water chemical analyses. The concentration of each inorganic species was plotted on a site map and contoured to illustrate the distribution over the site. During the first sampling field trip all ground-water samples were analyzed for acidity, ammonia, chlorides, dissolved solids, nitrates, sulfates, volatile and base/neutral priority pollutants, and selected organic compounds. Sampling schedules were modified during the subsequent sampling periods based upon the results of the first sampling.

Approximate ambient or background values for chemical constituents in the ground water found in the glacial sediments of the Wilmington area, based on values listed in the USGS Water Supply Paper No. 1694 (1964) are shown in the following table.

Parameter	pH	Specific Conductance (umhos)	Temperature (°C)	Alkalinity (mg/l) as $CaCO_3$	Nitrogen (mg/l)	Chloride (mg/l)	Sulfate (mg/l)
Background Value	6.1	260	9.9	15	<1	4	11

o Specific Conductance. The contour map of specific conductance of ground waters collected from the site is shown in Figure IV-4. Specific conductance is a measure of the ability of a water sample to conduct an electrical current, a property which depends on the total concentration of chemical species dissolved in the water. Because the total concentration of dissolved species controls the specific conductance of water, Figure IV-4 can be interpreted as a map of the total dissolved material in the ground water. [redacted]os). [redacted]

[redacted] The specific conductances of the waters from each well fluctuated between sampling periods, but generally remained in the same order of magnitude. The general distribution of specific conductance shown in Figure IV-3 is observed through all sampling periods.

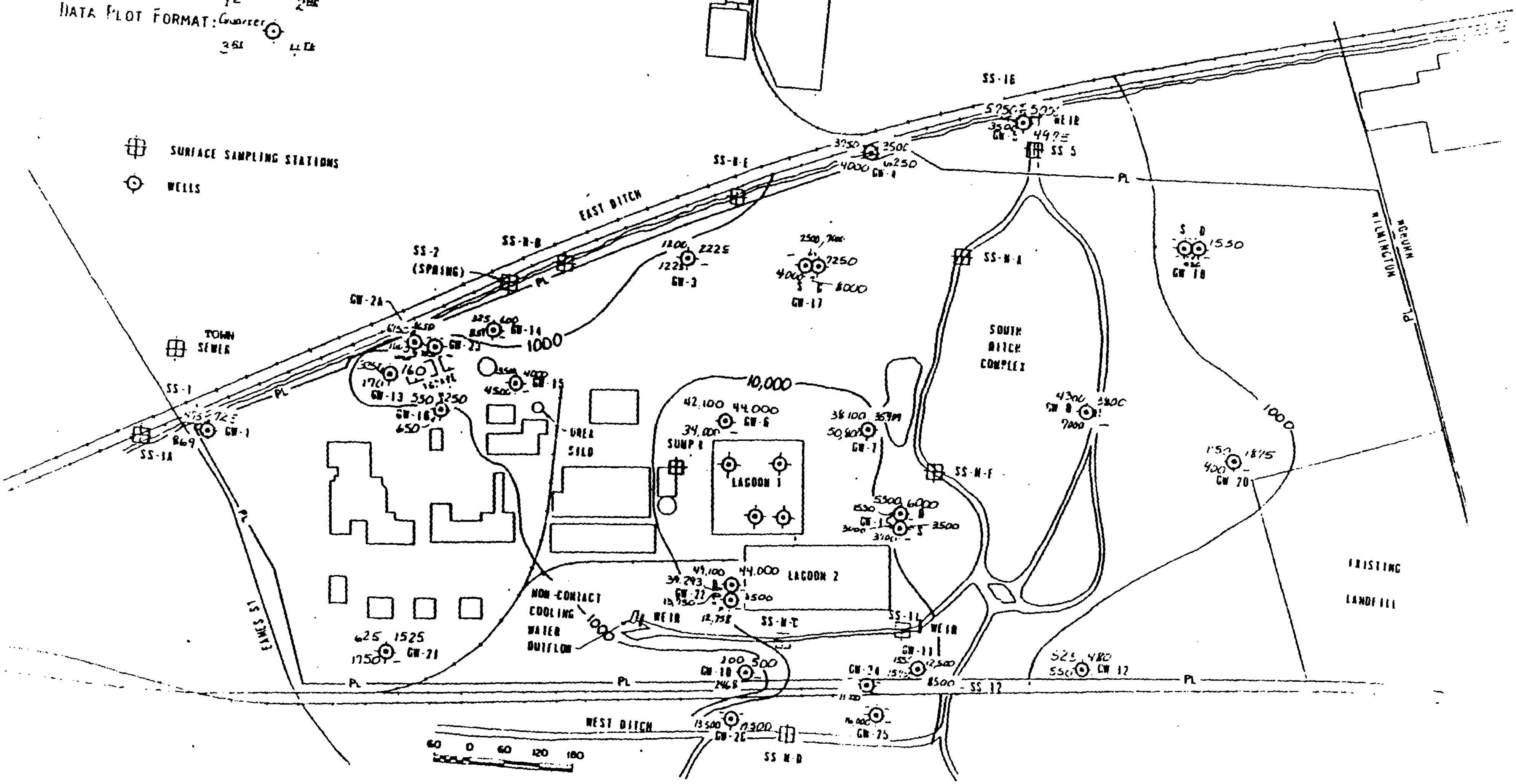
[redacted] there appear [redacted]

GENERALIZED CONTOUR OF SPECIFIC CONDUCTANCE
IN GROUND WATER (u MHOS)

(BASED ON 1ST QUARTER DATA)

DATA PLOT FORMAT: 1st Quarter 2nd 3rd 4th

FIGURE IV-4



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the site, the sludge disposal lagoons and nearby sumps and the area surrounding the storage tanks. From these two source areas, materials seem to migrate with the ground water, predominantly to the south and southeast, but with a localized discharge from the southwest of Lagoon 2. There appears to be dispersion of the materials with migration, thus mitigating any possible impacts on surface water quality.

o <u>pH</u>. Ground water from wells directly to the east of Lagoon (GW-6, GW-7) and near the west boundary (GW-10) have low pH values. Wells in the extreme southern portion of the site (GW-18 and GW-20) have high pH values (9 to 11). The contour map of pH of ground waters collected from the site is in Appendix 6.

The pH of ground waters collected from beneath the storage tanks area varied from 4.5 to 6.9. The low pH values to the east of the lagoons, GW-6, are indicative of the presence of a source of H+ ions, such as an acid. Since the long abandoned acid neutralization pits were located in this area, remains of waste disposed there are a likely source of H^+. Low pH's in GW-10 also may be indicative of past on-site activities. The other area of low pH (GW-12) is located in the swampy area surrounding the southern stream where humic acids may be produced as a result of organic decay. The ground water sampled to the west of the lagoons (GW-11, GW-22S), have high pH values (8-10). The high pH values associated with part of the area around the lagoons may indicate contribution of basic anions from lagoon leakage. It is unclear why there are high pH values south of the South Ditch complex.

Relative pH values also tend to be consistent over the four sampling periods, but a general low in pH was observed in all wells in April and May. Comparison of pH values collected by GEI, Olin, EPA, and Pirnie shows that, except for a decrease in GW-6 and GW-8 and an increase in GW-11, the pH of ground water beneath the site has remained relatively constant.

Ground waters collected on-site were generally in the 5 to 7 range.

o <u>Chloride and Sulfate</u>. Chloride and sulfate behave in a similar manner to the specific conductance. These chemicals are found in high concentrations (Cl^- >1,000 mg/l, $SO_4^=$ >10,000 mg/l) near the lagoons and process buldings, in a pattern similar to the distribution of specific conductance. A contour map of chloride and sulfate concentrations in ground waters ampled from the site is in Appendix 6. The probable discharge directions, shown by the dashed lines, are the same as those for specific conductance, and concentrations are greater in the deep wells (versus the shallow wells). Comparison of samples collected previously by EPA, Olin and GEI and during the four sampling periods by Pirnie shows that concentrations of chemicals in the wells on the site generally remained constant over five years. Concentration of chloride decreased by an order of magnitude in wells GW-3 and GW-8 between the 1977-1978 sampling and the 1981 sampling. Conversely, the concentration of sulfate increased by an order of magnitude in GW-6 and GW-7 and by two orders of magnitude in GW-2 and 2A.

Also the concentrations of chlorides and sulfates were higher in the deeper wells than in the shallower wells of the nested well systems; this is not surprising considering our understanding of possible past activities. For instance, liquids with high specific gravities would tend to migrate downward.

[redacted]. It should be noted that there are no known activities related to the storage tanks which account for the presence of the chlorides and sulfates. However, a leaking sewer was replaced in that area during 1981.

o Alkalinity. Alkalinity is the ability of a solution to buffer (neutralize) acid. Since bicarbonate (HCO_3^-) is the dissolved species which buffers acid (i.e., reduces H^+ concentration) in the pH range of natural waters (4.5 to 8.3), alkalinity is usually expressed as concentration of $CaCO_3$. The contours show that the highest alkalinities (>1,000 mg/l) were observed in ground waters sampled to the west and south of the lagoons. Alkalinities greater than 100 mg/l are found in the area of the northeast storage tanks, as well as in the area around the sludge landfill. Waters from the other wells on the site generally have alkalinities less than 100 mg/l (within the range of natural waters). Alkalinity remained within the same order of magnitude in most of the wells over the entire 1981 sampling period. Alkalinity values in wells GW-6, GW-7, GW-10, and GW-12 varied by more than an order of magnitude, but always remained in the range of normal ground waters. Alkalinity was greater in deep wells than in shallow wells in all of the nested wells.

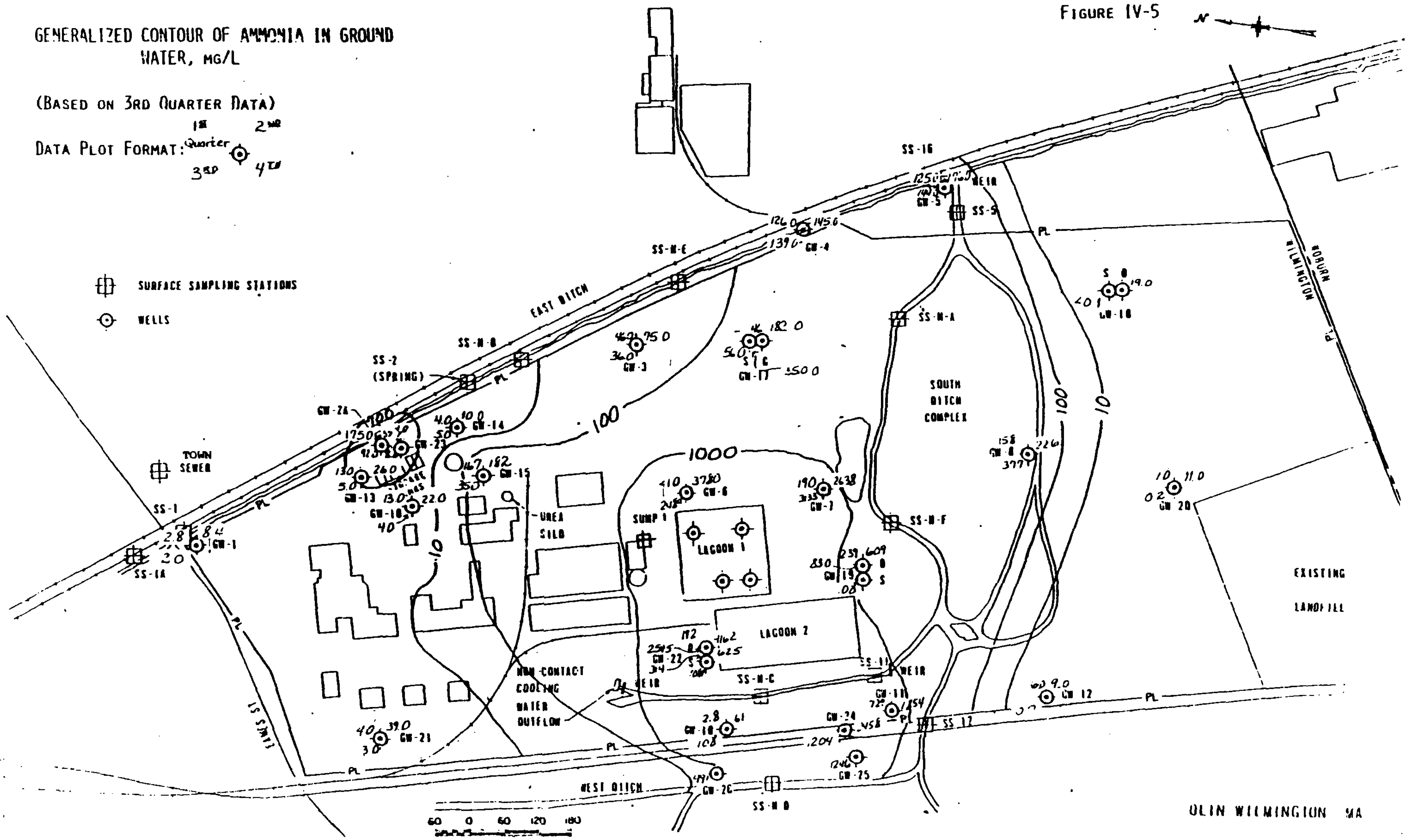
Sources of high alkalinity appear to be primarily the lagoons and, secondarily, perhaps the landfill or previous disposal activities for gypsum sludge. A contour map is in Appendix F.

o Ammonia. A contour of ammonia concentration, shown in Figure IV-5, shows that ammonia concentration, like most other dissolved species, [redacted] The wells around the storage tanks also have concentrations which may exceed 100 mg/l. The ammonia concentration in any given well usually remained within the same order of magnitude during the year, but higher concentrations of ammonia (varying by as much as an order of magnitude in wells GW-2 and GW-11) were observed in during May through August. As with the chlorides and sulfates, concentrations of ammonia in the deep wells exceed concentrations in the shallow wells of the nested well systems.

FIGURE IV-5

GENERALIZED CONTOUR OF AMMONIA IN GROUND WATER, MG/L

(BASED ON 3RD QUARTER DATA)



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The major source of ammonia is believed to be leakage from the lagoons and related facilities. A secondary source is the area around the storage tanks and may be related to the leaking sewer repaired earlier in 1981. Ammonia moves along the predominant routes of ground-water flow.

- Nitrates and Nitrites. Like the other chemical species, the highest concentrations of nitrates and nitrites (greater than 100 mg/l) are found near the lagoons with decreasing concentrations (1 to 10 mg/l) with increasing distance from the lagoons. The distribution shown is representative for a wet or dry season condition because nitrate and nitrite concentrations generally remained within an order of magnitude at any given well, except in GW-2 and GW-22D, where concentrations decreased by an order of magnitude and GW-22S where concentrations increased by an order of magnitude. Most wells showed an increase in these species in the dry season except GW-5 in which the concentrations decreased by two orders of magnitude. Nitrate and nitrite concentrations in the nested wells show no consistent patterns. Nitrate concentrations in 17D are greater than in 17S, less in 19D than 19S, and switch from a greater concentration in 22D to a greater concentration in 22S over the sampling period.

Measurements of dissolved oxygen in the wells on the site show that even in wells where ammonia concentrations are high, the dissolved oxygen concentrations are high. One would expect that nitrification would occur in ammonia bearing waters. Further, the ground water would be depleted in oxygen since nitrification is an oxygen consumptive reaction. However, it is possible that in areas with high ammonia concentrations are and/or low pH's that the nitrification reaction is erratic. However, it is believed that at least some of the nitrates and nitrites measured on the site are produced from nitrification. A contour map is in Appendix F.

o <u>Chromium (+3 and +6)</u>. A contour map of chromium +3 is shown in Figure IV-6. Initially, high concentrations of total chromium were found in wells near the lagoons in acidified samples. Subsequent unacidified samples were analyzed for Cr^{+3} and Cr^{+6}. Chromium +3 generally occurred in concentrations at or below detection limits over the site, except in the area around the lagoons (GW-7, GW-22D) where it occurred in high concentrations (> 1 mg/l). The distribution shown is representative of chromium distributions throughout the year because concentrations have remained within the same order of magnitude during the entire sampling period with slight increases during the dry season. Nested wells 22D and 22S, the only nested wells with large enough concentrations to compare, indicate that chromium is more concentrated in the deeper glacial till sediments than in the shallow sands.

Chromium +6 occurred in low concentrations around the lagoons and was generally below detection limits over the rest of the site. The area around the landfill initially had moderate concentrations of Cr^{+6} (0.36 mg/l in GW-18D, 0.39 mg/l) which dropped to below detection limits by the last sampling period.

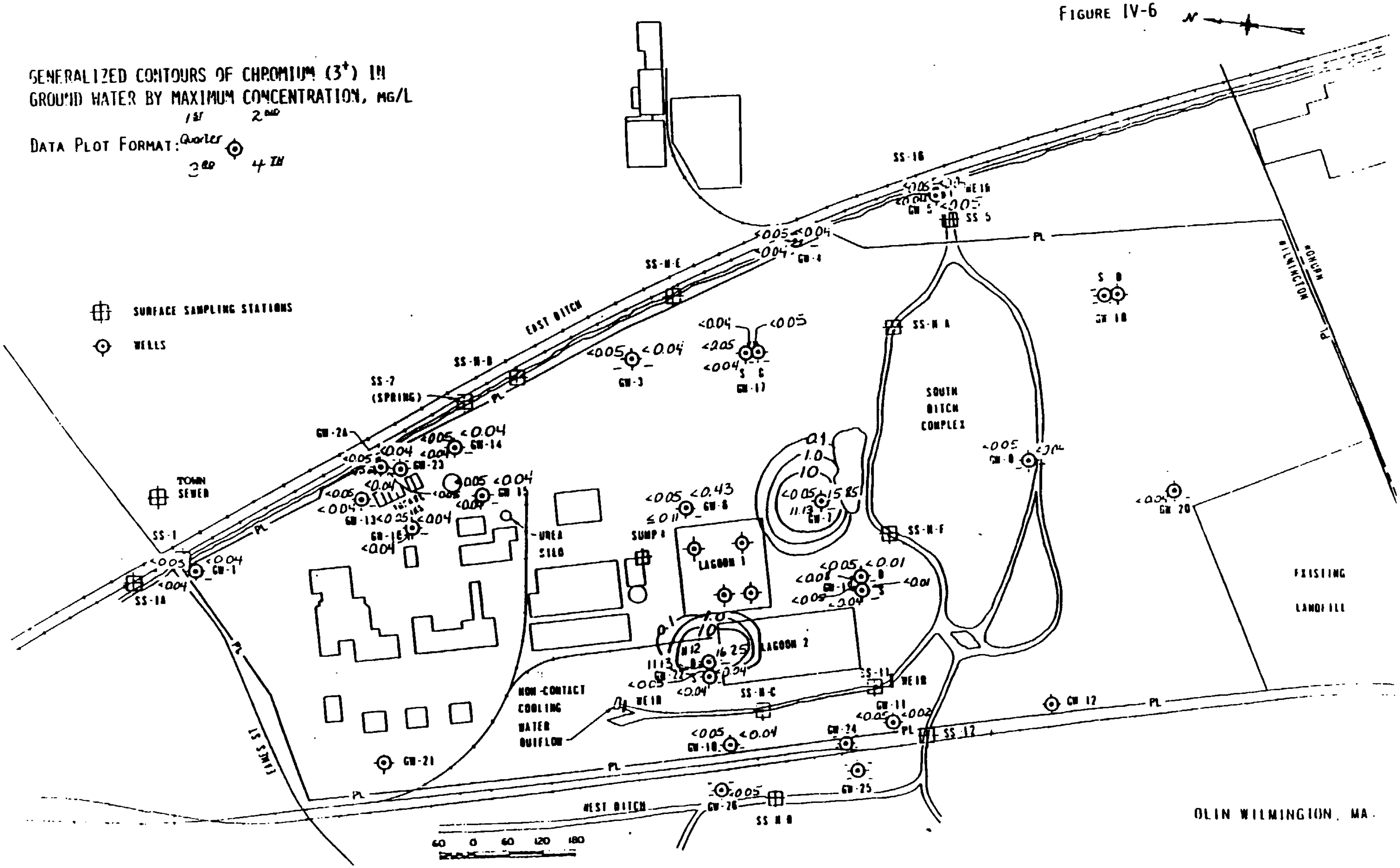
The source of chromium shown in Figure IV-6 is located around the lagoons. Chromium wastes were known to have been disposed in this general area. Since chromium +3 and +6 concentrations dropped to levels near or below detection limits by the end of the sampling period, especially at the site periphery, chromium should not be an element of concern.

o <u>Cadmium and Lead</u>. Water samples were also analyzed to determine concentrations of cadmium and lead. Elevated concentrations were found primarily in wells near the lagoons with some slightly elevated concentration in wells down gradient of the lagoons. In several cases, these concentrations decreased to low or below detection levels during the sampling period.

FIGURE IV-6

GENERALIZED CONTOURS OF CHROMIUM (3+) IN GROUND WATER BY MAXIMUM CONCENTRATION, MG/L

DATA PLOT FORMAT: 1st Quarter, 2nd; 3rd, 4th



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The source of the cadmium and lead may be associated with the chromium source. Since the levels of these constituents decreased to near or below detectable limits over the sampling period, particularly at the site boundaries, these materials appear to be of no concern.

o <u>Temperature and Dissolved Oxygen</u>. Field measurements of temperature and dissolved oxygen content were made. Temperatures were within normal ranges of ambient values. Dissolved oxygen measurements indicate that the ground-water system exists under aerobic conditions. These parameters do not reveal any patterns which would indicate directions of ground-water flow or contaminant source and transport, such as a thermal gradient or indications of possible degradation due to anaerobic conditions.

Comparison of nested well data shows that the concentrations of inorganic constituents are greater in the glacial till than in the upper sand layer. This is not surprising since the ground-water flow is slower in the till; the present measurements may represent fluids which infiltrated the site at some previous time, but have not yet had adequate time to reach the site boundaries. Also, any fluids with a high specific gravity would have had a tendency to move more quickly downward through the sandy upper layer to the till.

<u>Surface Water - Inorganic Chemistry</u>

The concentrations of chemicals dissolved in surface waters flowing from the Olin site were measured to determine the mass of chemicals discharged from the site by surface water.

o <u>pH</u>. The pH of waters on the site generally range from moderately acidic (5.1) to slightly basic (7.4) with the average slightly acidic. These values are within the range of natural surface-water values. The spring in the East Ditch (SS-2), showed a basic pH value of 8.6. This indicates that the water in the spring has come in contact with materials related to man-made activities.

o Specific Conductance. Specific conductance of surface waters tested on the site ranged from 325 to 58,000 umhos. The lowest values were found at SS-1. SS-1 is upstream of points where chemicals discharge from the Olin site and is only somewhat above the ambient conditions which would be expected for this type of watershed. The relatively low values found at SS-11 reflect that non-contact cooling water was being sampled. Specific conductivity of surface waters tested at the downstream East Ditch sampling sites was generally greater than that at the related upstream site by several fold. Further, the values at SS-12 (end of West Ditch) and at SS-5 generally were even higher than at SS-16. Overall these values are indicative of contributions of materials from the site. The highest values of specific conductance (1,000 to 8,000 umhos) were observed down-gradient of the lagoons.

o Chlorides and Sulfates. Chlorides and sulfates both show distributions similar to the distribution of specific conductivity of surface water on the Olin site. The lowest chloride and sulfate concentrations were found in the station at the upstream boundary of the site (i.e., SS-1). While concentrations of these materials generally increased somewhat at the spring (SS-2) on the eastern boundary of the site. Based on ground-water data it appears that inputs of sulfates and chlorides occurred along the entire ditch; however, ground-water reach 2 (which is downstream of the reach containing the spring) appeared to contribute the most chlorides and sulfates. Of interest was that the pick-up of chlorides along the East Ditch has declined significantly over recent months; the pick-up of sulfates declined slightly.

High chloride sulfate values are present at SS-12 and SS-5. These values were most likely a result of influence from the lagoons or past activities on-site.

Of particular interest was the dramatic increase in the sulfate concentration to 4,220 mg/l at SS-5 right after a rain event in time. Data from other South Ditch sampling points indicate surface scour of sulfate deposits in the South Ditch area occurred.

Comparatively low concentrations of chloride (51 to 100 mg/l) and sulfate (30 to 66 mg/l) were observed in SS-11, due to the nature of the water being sampled and to possible dilution effects.

o <u>Nitrogen Species and Alkalinity</u>. The concentration distribution of ammonia and nitrate was nearly the same as specific conductivity. Low values were observed at the up-stream boundary of the site at SS-1 (ammonia = <0.1 to 0.6 mg/l, nitrate = 0.9 to 2.1 mg/l and alkalinity = 41 to 366 mg/l). An increase in values was observed at the downstream monitoring location (SS-16). However, as with the chlorides, there is evidence of a decline over recent months along the East Ditch. While the spring at SS-2 appeared to have an ammonia input, based on ground-water data the ammonia appeared to enter along the entire East Ditch.

At both SS-5 and SS-12 earlier high values of ammonia and alkalinity also have declined recently. High concentrations of these materials were found in the lagoon liquid; hence the lagoons and related facilities are a source of the ammonia.

Low concentrations were again observed in SS-11 (ammonia = 2.8 to 17 mg/l, alkalinity = 28 to 800 mg/l), due to the nature of the non-contact cooling water. Nitrate nitrogen values were generally low throughout the study area except for the spring SS-2. Also some nitrate was measured in the lagoon liquid.

o <u>Chromium (+3 and +6)</u> - Concentrations of total chromium were initially found in the range from 0.010 to 0.42 mg/l, in acidified samples. However, in unacidified samples, chromium +3 and +6 to near or below the detection limits. By the end of the sampling session, concentrations of both species in all sampling stations had dropped below detection level (<0.05 mg/l for Cr^{+3}, <0.01 mg/l for Cr^{+6}).

o Cadmium and Lead - Surface water samples were analyzed for concentrations of dissolved lead and cadmium. Concentrations of these chemicals dropped below detection levels (0.04 mg/l for Pb and 0.01 mg/l for Cd) by the last sampling period.

Effects of the Existing Landfill

There is an existing landfill on the southwest corner of the site. This landfill was used by previous operators mainly for the disposal of calcium sulfate sludge. Because calcium sulfate is somewhat alkaline, high values of alkalinity, pH, and sulfate concentration in wells downgradient of the landfill would indicate contamination of ground water by chemical species leached from the landfill. Also the Woburn town sanitary landfill is located to the south of the site but may be in a different watershed. Sanitary landfills tend to have acidic leachates. Hence low values of pH and alkalinity would indicate an influence from the sanitary landfill. Since the Woburn landfill appears to be in a different watershed minimal influence was expected and none was found.

Sulfate concentrations are two orders of magnitude less (10-100 mg/l) in wells which would be affected by the existing landfill (GW-20, GW-18) than in the areas around the sulfate lagoons where sulfate concentrations are on the order of 1,000 to 35,000 mg/l. Sulfate concentrations in the wells which would be affected by the Olin landfill are only slightly higher than background levels. However, pH's of waters which could be influenced by the existing landfill (9.3 to 11.3) are three to five units above background level (6.1). The values are higher than would be expected for lagoon sludge (8.7 to 9.6).

The alkalinities of waters collected from wells that would be influenced by migration of materials from the existing Olin landfill are on the order of 160 to 350 mg/l, which is the same order of magnitude as concentrations in the wells around the lagoons. This is a moderate to high range of values compared with waters sampled from wells in other areas of the site and is an order of magnitude above the reported background surface water values of 15 mg/l.

pH and alkalinity levels which are elevated an order of magnitude or more above background levels indicate a possible movement of materials in ground water emanating from the existing Olin landfill. However, since the sulfate concentrations in the area down-gradient of the landfill are in the same order of magnitude as background levels, the effect of the Olin landfill on the ground water is considered to be minor.

Comparison of Ground-Water and Surface Water Chemistry

Comparison of ground-water and surface-water chemistry shows that materials of interest are distributed as would be expected for the hydrological system described above. Concentrations of inorganic materials are low in both the surface and ground waters upstream of the site. Concentration of materials dissolved in both ground and surface waters increases as water flows through the site. Plots of distribution of inorganic materials in ground water indicate that high concentrations (especially ammonia) are distributed under the entire area of lagoons, storage tanks and plant area. This ubiquitous distribution of materials suggests that sources other than the lagoons or storage tanks, such as the past practices and underground piping may continue to discharge chemicals into the ground water and then into the surface water. However, concentrations of materials dissolved in the ground water generally decrease with increasing distance from the source areas and concentrations in the surface waters are generally in the range of expected values if the ground waters are discharging and mixing into the surface water.

Inorganic Emission Rates

Comparison of the emission rates of materials in ground water into the surface water strongly supports the premise that materials traveling in the ground water are discharged to the three ditches which surround the site. Under dry conditions in August, emission rates were approximately 260 lbs/day chloride, 535 lbs/day of sulfate, and 185 lbs/day of ammonia, and were calculated to be discharged from the ground water into the ditches, as shown in Table IV-4. Under the same dry conditions, the net chemical load from all surface water discharged from the site was 350 lbs/day of chloride, 600 lbs/day of sulfate, and 350 lbs/day of ammonia. This seems to be a reasonably good balance.

During more typical conditions in April (several days after a rain event), ground-water discharges were approximately 480 lbs/day of chloride, 2,065 lbs/day of sulfate, and 185 lbs/day of ammonia, as shown in Table IV-5. At the same time the total net load emitted from the site as gauged at SS-16 and SS-5 was 535 lbs/day of chloride, 930 lbs/day of sulfate, and 350 lbs/day of ammonia. This also was a reasonably good balance. The sulfate loading in the ground water may be elevated because of flushing by water infiltrating from recent rain events. The sulfate loading in the surface was low because water was being ponded in the South Ditch complex. The ammonia emissions are comparable with values obtained by GEI in 1978.

Further, if Lagoon 2 is in the same condition as Lagoon 1, then comparable inputs of chloride, sulfate and ammonia into the ground water are possible. Rough calculations indicate that the two lagoons could leak about 125 to 500 lbs/day of chloride, 400 to 1,600 lbs/day of sulfate and 100 to 400 lbs/day of ammonia.

However on a day in June after a 1.5 inch rainfall, the net surface water discharge rates were 920 lbs/day of chloride,

TABLE IV-4

COMPARISON OF GROUND-WATER AND SURFACE WATER DISCHARGE RATES (AUGUST DATA)

GROUND WATER

Boundary	Reach	Discharge (gal/day)	[Cl^-] (mg/l)	Cl^- Mass Discharge (lbs/day)	[SO_4=] (mg/l)	SO_4= Mass Discharge (lbs/day)	[NH_3] (mg/l)	[NH_3 Mass] Discharge (lbs/day)
East	1	31,000	95	25	80	21	9.2	2
	2	14,000	42	5	362	42	36	4
	3	7,600	465	29	1,150	73	179	11
	4	9,500	25	2	73	06	BDL	-
Subtotal		62,100		61		142		17
South	3	7,480	1,600	100	2,300	143	1,204	75
	5	3,740	2,200	69	5,680	176	2,458	77
	6	748	250	2	590	4	108	1
Subtotal		11,970		171		323		153
West	5	-0-		-		-		-
	6	13,942	250	29	590	69	108	13
	7	710	110	0.1	11	0	2.6	0
Subtotal		14,013		29		69		13
Total		88,100		261 lbs/day		534 lbs/day		183 lbs/day

SURFACE WATER

	Discharge	Cl^- Mass Discharge	SO_4= Mass Discharge	[NH_3 Mass] Discharge
Approximate Net Discharge	77,500	350 lbs/day	600 lbs/day	350 lbs/day

TABLE IV-5

COMPARISON OF GROUND-WATER AND SURFACE WATER CHEMICAL DISCHARGE RATES (APRIL DATA)

GROUND WATER

Boundary	Reach	Discharge (gal/day)	[Cl^-] (mg/l)	Cl^- Mass Discharge (lbs/day)	[$SO_4^=$] (mg/l)	$SO_4^=$ Mass Discharge (lbs/day)	[NH_3] (mg/l)	[NH_3 Mass] Discharge (lbs/day)
East	1	11,000	2,150	197	35	3.2	6.3	0.57
	2	24,000	66	13	831	166	27	5.4
	3	7,300	474	29	2,325	141	137	8.3
	4	8,200	163	11	1,030	70	12	0.82
Subtotal		50,500		250		380		15
South	3	14,960	1,083	135	10,635	1,325	635	80
	5	1,220*	2,040	21	7,900	80	2,002	20
	6	464	2,040	8	7,900	30	2,002	8
Subtotal		16,644		164		1,435		108
West	5	-0-						
	6	3,800	2,040	65	7,900	250	2,002	63
	7	19	112	0.02	6	<0.01	7.3	<0.01
Subtotal		3,819		65		250		63
Total		71,000		480 lbs/day		2,065 lbs/day		185 lbs/day

SURFACE WATER

Net Discharge		252,000		535 lbs/day		930 lbs/day		230 lbs/day

7,200 lbs/day of sulfate and 900 lbs/day of ammonia. The increase in total net loading from the site is believed to have been caused primarily by a great increase in the surface water discharge related to the high-intensity precipitation event. The marked increase in concentration of some materials (especially sulfate) under wet conditions may be due to scouring of materials from the ground as surface water flows over the site.

Conversely, the net load emitted in the surface water in December, a period of sustained wet conditions in which high loading rates would be expected, decreased to approximately 110 pounds per day of chloride, 425 pounds per day of sulfate, and 81 pounds per day of ammonia. The chloride and ammonia emissions were significantly lower, while sulfates were only somewhat lower. As will be discussed later, while it is believed that remedial measures enacted to date may have contributed to this reduction in part, additional data are needed before this reduction can be classified as more than part of a downward trend.

Organic Material Analyses

Ground-water and surface water samples were analyzed for volatile and base/neutral (B/N) priority pollutants. On several samples non-priority pollutant volatile and B/N materials were identified. For convenience in this report, organic data were grouped into three ranges: a lower range - above detection limits but less than 0.05 mg/l, medium range - 0.05 to 0.20 mg/l; and an upper range - concentrations greater than 0.20 mg/l. The discussion of the data in terms of ranges seems appropriate given the known analytical variability.

Ground-Water Volatiles

Volatiles. Olin ground-water samples were analyzed for 31 volatiles listed on the Priority Pollutant list. The thirteen volatiles listed below were detected at least once at the Olin site. The data are in Appendix E.

1. Benzene
2. Bromoform
3. Carbon Tetrachloride
4. Chlorodibromomethane
5. Chloroform
6. Dichlorobromomethane
7. 1,2 Dichloroethane
8. Ethylbenzene
9. Methyl Chloride
10. Methylene Chloride
11. 1,1,2,2 Tetrachloroethane
12. Toluene
13. 1,1,1 Trichloroethane

Of the compounds listed above, volatiles with elevated concentrations in the ground-water regime are bromoform, 1,2 dichloroethane, toluene, and methylene chloride. Methylene chloride concentrations fluctuated widely over the sampling period and over the site. Methylene chloride was found in upper range concentrations (GW-4, GW-5, SS-5, SS-12) during the last sampling round, but there appeared to be no correlation with other compounds. Although the possibility cannot be discounted that minor amounts of this compound were used on-site in the past, it is more likely that the erratic methylene chloride results are related to analytical problems commonly associated with the use of this compound in certain laboratory procedures; therefore, it will not be discussed further in this report.

There appear to be two minor areas of volatiles in the ground water. The first area is around the northeast storage tanks, where mid to upper range concentrations of toluene were found in wells GW-2+2A and GW-16.

The second area of high concentration is around the lagoons and the nearby plant area. Moderate to high concentrations of bromoform, 1,2 dichloroethane and toluene appear in wells GW-6, GW-7 and GW-19D which surround the lagoon area. As discussed earlier, Lagoon 1 (and probably Lagoon 2) is believed to have had a ruptured liner during this study. This condition would have allowed infiltration of liquid into the ground water. Analysis of the Lagoon 1 liquid showed it to have lower range concentrations of 1,2 dichloroethane and toluene.

The vertical location of the volatiles in the subsurface does not appear to be controlled by the geology. A comparison of the nested well data obtained from the shallow and the deep wells indicates that there appears to be no correlation between the depth of a well and its volatile concentration. This is to be expected since volatilization of these compound may act as a significant removal mechanism before the compounds reach the ground water.

The most significant factor governing the location of volatiles is proximity to the source of contamination. It appears that volatile concentrations drop off significantly a fairly short distance away from the areas of concentrations above 0.2 mg/l. Although there may be minor areas of upper range volatile concentrations on-site, by the time the ground water discharges into the surface water, volatile concentrations consistently have dropped to near or below detectable limits. Thus, there appears to be little or no input of volatiles from the ground water at the Olin site into the surface water.

The variation in volatile concentrations between wet and dry conditions also shows no pattern. Since most of the variations were within an order of magnitude, the variations seen may be due to natural fluctuations in the ground water.

<u>Surface Water - Volatiles</u>

Of the twelve volatiles detected in the ground water (excluding methylene chloride) only five were detected in the surface waters. One volatile was detected once in the surface water but not in the ground water. The data are in Appendix 5. Of significance is that volatiles were only measured in the East Ditch and with the exception of one trichloroethylene sample, the highest concentrations were entering the site at station SS-1 on the northern boundary. Supplemental sampling to the north of the site in the East Ditch (SS-1A) confirmed that lower range concentrations of chloroethane and 1,1,1 trichloroethane and high concentrations of toluene were originating from off-site.

By the time station SS-16 was reached, the chloroethane and 1,1 dichloroethane were below detection limits. Also the toluene and 1,1,1 trichloroethane concentrations were reduced significantly by the time SS-16 was reached. For instance, in December the toluene concentration dropped from 0.31 mg/l at SS-1 to 0.043 mg/l at SS-16, while the flow only increased 70 percent across the site. Further, the concentrations of toluene and 1,1,1 trichloroethane decreased over the course of the study at both SS-1 and SS-16.

In regard to trichloroethylene, it was only measured above detection limits in one sample at SS-16. The source of the 0.053 mg/l measured in that sample is unclear. It is possible that it is related to off-site man-made activities to the east of the Olin site; a drainage pipe does enter the East Ditch from the east just a few feet downstream of SS-16.

Overall, the Olin site is not believed to be the source of any volatile organic compounds in the surface water. Hence no discharge rates were calculated.

Ground Water - Base/Neutrals

Olin ground-water samples were analyzed for forty-one base/neutral (B/N) compounds by CompuChem. The eleven listed below were detected at least once at the site. The data are in Appendix E.

1. Acenapthalene
2. Anthracene
3. Bis (2 ethylhexyl) Phthalate (DOP)
4. 4-Bromophenylphenyl ether
5. Butyl Benzyl Phthalate
6. Di-N-Butyl Phthalate
7. Fluorene
8. Napthalene
9. N-Nitrosodiphenylamine
10. Phenanthrene
11. Dioctyldiphenylamine

Only six of the above compounds were found in elevated concentrations in the ground water: bis (2 ethylhexyl) phthalate (DOP), butyl benzyl phthalate, di-n-butyl phthalate, "N-nitrosodiphenylamine" and dioctyldiphenylamine. N-nitrosodiphenylamine was actually detected as diphenylamine by CompuChem; the diphenylamine also included N-nitrosodiphenylamine. Further analysis showed that the "N-nitrosodiphenylamine" values listed in Appendix 5 are only approximately 20% N-nitrosodiphenylamine, based on analysis of one sample.

[redacted] GW-14, GW-15, GW-16, and GW-23. This source appears to be very localized and is probably due to past activities in the area around the tanks. [redacted] in [redacted] concentrations of DOP and low concentrations of [redacted]

DOP occurs in upper range concentrations in both areas, with the highest concentrations occuring near the storage tanks. DOP is present over most of the site. It was detected in 20 out of 25 wells analyzed for DOP. A generalized contour map is shown in Figure IV-7.

N-Nitrosodiphenylamine and dioctyldiphenylamine are distributed around the source areas in a similar fashion to DOP, but they are less widespread over the site. Butyl benzyl phthalate and di-n-butyl phthalate occurred in low to moderate concentrations around the two source areas.

A comparison of concentrations over the course of this study indicates that there is no clear-cut change in B/N

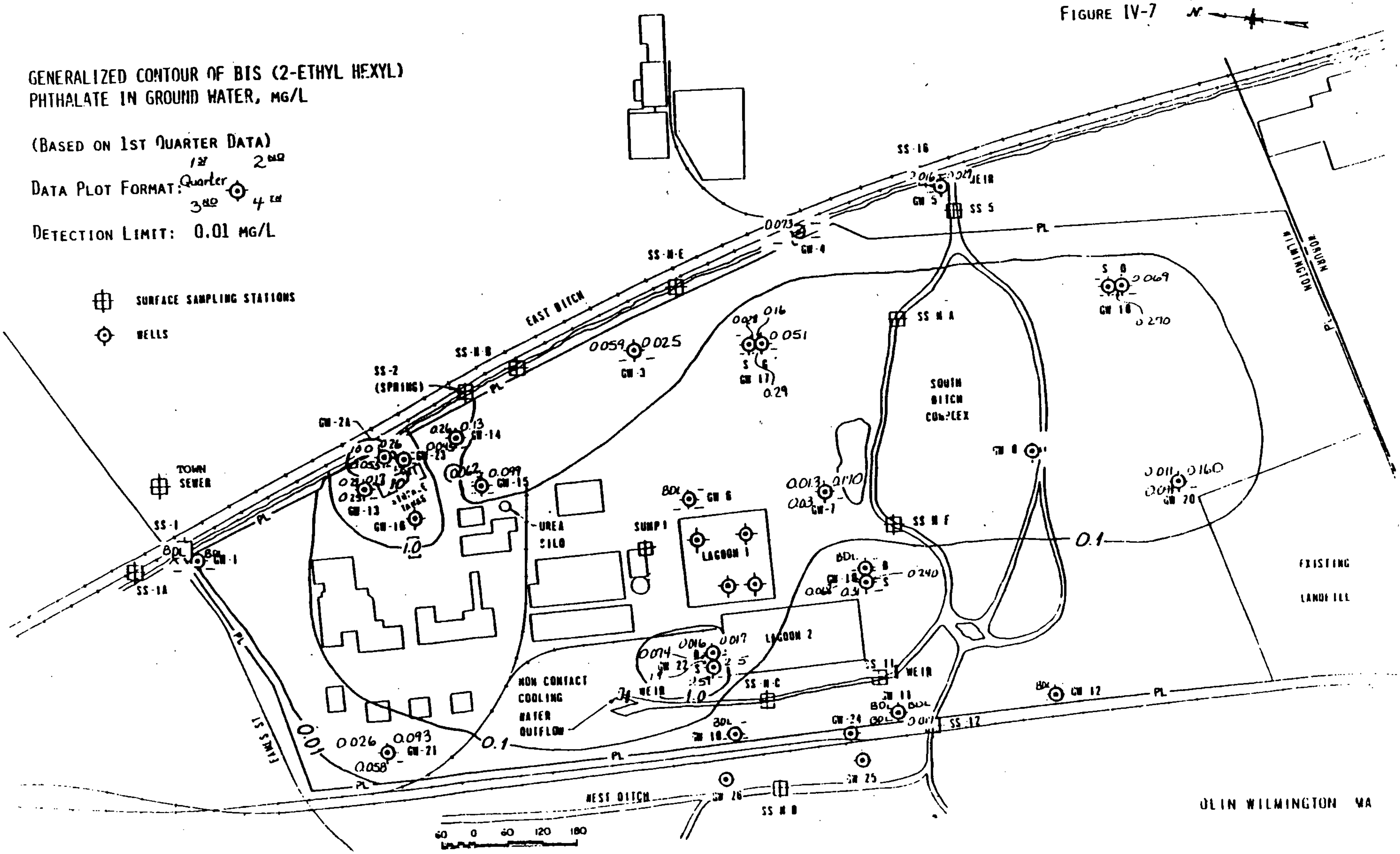
Figure IV-7

GENERALIZED CONTOUR OF BIS (2-ETHYL HEXYL) PHTHALATE IN GROUND WATER, MG/L

(Based on 1st Quarter Data)

Data Plot Format: 1st Quarter 2nd / 3rd 4th

Detection Limit: 0.01 MG/L



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concentrations over time. However, certain materials such as di-n-butyl phthalate, and butyl benzyl phthalate have decreased in concentration during the study.

Vertical Distribution of Base/Neutrals - There appears to be some correlation between the type of subsurface material and concentrations of base-neutrals, in particular, DOP. Wells whose screens are set in the till generally seem to have higher concentrations than the wells with screens set in the sandy outwash material. The nested well data show mixed results. GW-17S and GW-17D indicate that DOP is traveling in the deeper layers. GW-19S and 19D show the opposite; but since this area is a discharge zone, those results are not anomalous. GW-22S and 22D also show B/N movement primarily in the shallow zone.

The DOP concentrations generally seen in the deeper layers may possibly be a residual from past activities. In addition, the till generally has greater CEC values than does the outwash material, indicative of a greater capacity to adsorb contaminants. The sites for adsorption initially were filled during recharge by highly contaminated water in the past; less highly contaminated water now flowing through the till may be leaching contaminants from the adsorption sites. However, investigation of the area around the northeast storage tanks during the test pit work showed that the black liquid containing the majority of the base/neutral compounds primarily was contained in the unsaturated zone and at the surface of the ground water. The apparent immiscibility of the base/neutral compounds is supported somewhat by their relatively low solubilities. Overall, the mechanisms resulting in the vertical distribution of DOP (and to a lesser extent N-nitrosodiphenylamine) on the site are complicated.

Surface Water - Base/Neutrals

The base/neutrals that have been detected in the surface water are DOP, N-nitrosodiphenylamine, and, in one sample, dioctyldiphenylamine. Monitoring of the surface water at the Olin site indicates that discharge of B/Ns into the surface water occurs primarily on the eastern side of the site. B/Ns do not appear to be coming in from off-site to the north as was the case with the volatiles. SS-16, which monitors the East Ditch above the confluence, contained the highest concentrations of B/Ns: mid to upper range amounts of DOP, sometimes moderate amounts of N-nitrosodiphenylamine, and sometimes lower range amounts of dioctyldiphenylamine. Sources of the high concentrations of DOP and N-nitrosodiphenylamine in the East Ditch, shown by SS-16, are probably both leakage from the banks near the northeast storage tanks and from ground-water contribution. The spring in the East Ditch (SS-2) contributes lower range concentrations of DOP. SS-12, which monitors flow from the West Ditch and the area to the west of the site, contained no B/Ns at detectable levels, while the process-water outflow (SS-11) contained very low concentrations of DOP, just at the detection limit. South Ditch complex inflow (SS-5) to the East Ditch contained low to moderate amounts of DOP which decreased to below detectable limits in the last sampling period.

Variations Over Time - The DOP and dioctyldiphenylamine in the surface water have decreased somewhat over time. In the last sampling period, SS-16 was the only sampling station that showed any base/neutrals above the detection limit. However, it is possible that SS-5 may continue to contain DOP on an intermittent basis in the near future. At SS-16 DOP and N-nitrosodiphenylamine typically appeared in moderate concentrations. However, a high concentration of DOP occurred in May while N-nitrosodiphenylamine was below detection limits in August.

Emissions - While most of the DOP and N-nitrosodiphenylamine at SS-16 appears to be from the ground water, balances of emissions with surface water discharge were complicated by the use of absorbent booms in the East Ditch for organic recovery. Roughly 0.1 to 2.5 lbs/day of DOP were calculated to be emitted from the ground water, while 0.15 to 5.0 lbs/day were measured leaving the site. A typical value appeared to have been 0.4 lbs/day. In regard to N-nitrosodiphenylamine a typical value leaving the site during the study appears to have been 0.1 lbs/day (as N-nitrosodiphenylamine).

Other Organic Analyses

Non-priority pollutant volatile and base/neutral analyses were performed on samples taken during the 2nd quarter from one ground-water sampling station, GW-5, and three surface water stations, SS-2, SS-5 and SS-16. The analyses were performed in order to delineate other organics present at the Olin site. The data are in Appendix E.

There were no non-priority pollutant base/neutrals above detection limits in GW-5. The only volatile that was detected was acetone, at mid-range concentrations (0.05-0.2 mg/l).

Relative to the surface samples, the spring (SS-2) showed three base-neutral compounds at lower range concentrations (<0.05 mg/l). SS-5 contained no base/neutral compounds above detection limits and had one volatile, acetone, at upper range concentrations (>0.2 mg/l). SS-16 had four base/neutral concentrations at lower range concentrations and ten volatile compounds at lower to mid-range concentrations.

Comparing these results with previous analysis of non-priority pollutants performed by Olin shows that only one volatile compound was found in both samplings: 2, 4, 4 - Trimethyl-1-pentene. No base-neutrals were repeated in both periods. The source of the above materials is unknown.

V. RECOMMENDED PLAN FOR REMEDIAL MEASURES

Materials of Possible Concern

As discussed in the previous chapter, the Olin site is discharging variable quantities of three inorganic materials (ammonia, chlorides and sulfates) and low quantities of two organic priority pollutants (DOP and N-nitrosodiphenylamine). All other inorganic and organic materials studied appear to be of no concern.

The net ammonia discharge from the site was the lowest in the most recent sampling period in December 1981. It was measured at 81 lbs/day versus 350 lbs/day typically measured earlier in the study. This is considered to be part of a downward trend; without remedial actions sustained discharges below 100 lbs/day are not expected. Since the ammonia can contribute to water quality problems downstream of the site, this downward trend is encouraging. Additional actions appear warranted to assure that the trend continues. Lagoon 1 has already been renovated.

Similar to the ammonia, chloride discharges also were measured at their lowest levels in December. Net chloride discharges were 110 lbs/day versus more typical discharges of 350 to 535 lbs/day. While it is expected that this trend will continue as a result of remedial measures for other materials, it does not appear that even the typical chloride discharge represents a significant water quality problem.

While sulfate levels also dropped in December, the decline was not as much as with the ammonia or chlorides. While it is expected that this trend will continue as a result of remedial measures for other materials, even at typical values of 600 to 930 lbs/day, it does not appear that even the typical net sulfate discharges represent a significant water quality problem.

Insofar as priority pollutant organics are concerned, both DOP and N-nitrosodiphenylamine appear to be discharged at a typical rate of 0.4 lbs/day and 0.1 lbs/day for DOP and N-Nitrosodiphenylamine, respectively. Some additional action may be warranted. Appropriate remedial measures will be discussed below.

<u>Sources of Materials Being Discharged</u>

During the course of this evaluation two major source areas of materials being discharged were clearly identified: the lagoon area and related facilities; and the northeast storage tank area including the spring. A third "area" suspected to contribute is the underground piping.

The lagoons are believed to be leaking and contributing a significant portion of the ammonia, chloride and sulfate discharged from the site. Further, it appears that gypsum sludge has been generally deposited to the south of the lagoons from past practices and it is believed that scouring of this sludge may contribute to the high concentrations of sulfate in the surface waters.

The spring (SS-2) near the northeast storage tank area also is a secondary source of ammonia, chlorides and sulfates. The cause for this spring is unclear, but is suspected to be related to a piping leak of some type.

The major source of priority pollutant organics leaving the site is the northeast storage tank area. Test pit work in that area confirmed the general presence of organics believed to be related to the materials oozing through the bank of the East Ditch. Remedial actions have been implemented in this area.

During the course of this investigation it was determined that the effluent sewer discharging to the local sewerage system was leaking in the vicinity of the northeast storage tanks. This leakage is believed to have contributed mainly ammonia, chloride and sulfate to the ground water in that area. This corroded sewer was replaced during the investigation as a remedial measure. However, it is possible that others may also be leaking. Further, the influent sump to the treatment works was found to be leaking. This was also repaired during this study.

Remedial Measures

Any solution to a water contamination problem is complex. If no imminent hazard is present, then a phased approach is usually the most logical. Since no imminent hazard exists at the Olin site, a phased approach will be discussed. Of the inorganic and organic materials of possible concern discussed above, ammonia is considered to be of somewhat greater concern than the organics. The first phase of any remedial measures program should address reductions of ammonia. Chlorides and sulfates also are of some interest and are expected to be related to reductions in ammonia. The second phase of the program should address reductions in priority pollutant organics. The third phase would include monitoring to quantify the improvements obtained by earlier phases.

Phase I - Ammonia and Other Inorganics

The lagoons are the primary area for application of remedial measures for ammonia. As discussed earlier, the lagoons are believed to be the largest single source of ammonia. They also are a major source of sulfate and chloride, and a minor source of organics. The primary remedial measure in the lagoon area is excavation of sludge and replacing the liners with a more secure liner system. This action was completed for Lagoon 1 in December after the last sampling field trip. As a part of the lagoon liner replacement, ground water was pumped to dewater the lagoon for about two months. Improvements in water quality which have been observed recently may in part be a result of this dewatering action. Removing the sludge and replacing the liner in Lagoon 2 should further reduce the concentrations of ammmonia, sulfate, and chloride in the area around the lagoons and eventually in the surface waters. It is our understanding that Olin has scheduled repair of Lagoon 2 for this year (1982).

The new lagoon liner system consists of 12 inches of sand overlain by a 36 mil reinforced hypalon liner overlain by 12 inches of sand, filter fabric and 12 inches of gravel. This system represents a dramatic improvement in the ability to prevent future breaches in the liner. During the summer shutdown in 1981 a thorough inspection of the influent sump and on-site treatment facilities was made by Olin. The repairs discussed earlier are expected to reduce losses of inorganics.

A third action already completed was the replacement of the effluent sewer discussed earlier. This leakage not only discharged inorganics to the ground water near the East Ditch, but also probably increased the seepage rate through the bank of the ditch. It was recommended that an investigation of all underground piping be initiated to determine whether any other pipes are leaking. It is our understanding that a sewer inspection program has been implemented. Also, it is hoped that a point of origin for the spring (SS-2) could be found. Investigations to date have failed to locate anything which would serve as a source of head to drive water (and associated materials) upward into the East Ditch.

Another action worth considering is the relocation of the non-contact cooling water discharge to the East Ditch. This relocation might reduce hydraulic heads slightly on the western side of the site and also would reduce flows through the South Ditch complex.

Phase II - Organics

Discharge of both organic and inorganic chemicals from the site, especially into the East Ditch, can be decreased by remedial measures in the storage tank area. Initially, many different approaches were considered in order to reduce contamination associated with the storage tanks. However, supplemental test pit investigations help to narrow the list of possible actions by indicating that: 1) contaminated soil is more widely spread toward the plant than assumed in initial remedial calculations, 2) the area under the tanks is essentially lined by an impervious spilled resinous material, 3) the majority of the contamination is concentrated just above the water table and in the capillary zone (8 to 10 feet below grade). Hence, installation of an impermeable cap around and under the tanks was excluded because the area under the tanks is essentially lined by impervious spilled resinous material. Second, minimum (shallow) excavations around and under the tanks was eliminated because the zone of high concentration of organics in the soil was found too extensive to be removed by minimum excavation.

Measures considered included recovery wells, interception ditch, slurry wall around the area, detergent application and microbial degradation. Of these measures, detergent application, recovery, and disposal was eliminated because this would require extensive and costly feasibility studies both before and during the treatment process. Even in a well conducted cleanup, detergents may be difficult to control and may cause legal problems. Microbiological degradation was also rejected. Like detergent application, recovery, and disposal, microbiological degradation is a difficult process to control; it may also create unknown by-products and may be very costly. Of the three remaining techniques, a multiple recovery well system or an interception ditch with a recovery pump are fairly equivalent in effectiveness. Both approaches represent a positive action, but potentially a long-term commitment to remove materials from the ground water. While some organics may pass by either system, over the long term the discharge of organics will abate. It is anticipated that the recovered water would be discharged to the public sewerage system after decanting any organic layer generated.

Alternatively, the slurry wall approach represents an effort to contain the organics in place. This passive approach results in near-term discharge reductions, but retains the undesired potential for organic discharge at some time in the future. It is also more costly than a recovery well system or interception ditch. Considering the nature of the organics being discharged and all other factors, serious consideration was given to implementation of either a multiple recovery well system or an interception ditch. It is our understanding that Olin has implemented a multiple well recovery system.

Because contaminants which have accumulated in and on the banks of the East ditch represent a substantial source of contaminants which may be readily transported off the site by stream flow, removal of this material is deemed an essential remedial measure. During excavation, a series of sorbent booms and pillows should be installed downstream along the drainage ditch. Heavily contaminated sediment excavated from the channel (estimated at about 5 cubic yards, 20 drums) should be drummed and sent off-site. The remainder of the excavated material should be spoiled in front of the storage tanks. The excavated area should be filled with a clean coarse granular material.

The remedial measures described above should decrease the concentration of materials in the zone of organic ooze along the railroad on the eastern embankment.

Phase III - Monitoring

The measures proposed above should reduce the discharge of materials from the Olin site. However, further monitoring of the ground and surface water should be done to document the efficiency of the remedial measures implemented and to determine if any further action appears warranted.

The following schedule shows the suggested ground-water and surface water monitoring program for 1982 and 1983. The program should be implemented about 3 months after the removal of the sludge of Lagoon 2. The following tasks should be performed; all of these tasks would be subject to modification in scope based on previous results.

1. Ground-Water Levels: Water levels should be taken in all wells to monitor the ground-water flow and to observe any decreases in mounding around the lagoons.

2. Surface Water Flows: Surface water flows should be measured in the surface sampling stations listed in the schedule.

3. Chemical Analyses: The chemical analyses performed during each period should consist of the following parameters. The sampling stations and specific analyses to be performed for each period are listed in the schedule.

Inorganics:	Chloride (Cl)
	Sulfate (SO_4)
	Ammonia (NH_3)
	Specific conductance (S.C.)
	pH
	Chromium +3 (Cr^{+3})
Organics:	DOP
	N-nitrosodiphenylamine (N-N)

Monitoring Schedules - Two sampling periods, approximately 6 months apart, are recommended for 1982. Table V-1 shows the list of activities. Table V-2 shows the list of activities for the one recommended sampling period in 1983.

TABLE V-1

1982 MONITORING SCHEDULE

	Ground-Water Levels	Inorganics						Organics	
		Cl	SO_4	NH_3	S.C.	pH	Cr^{+3}	DOP	N-N
GW-1	*	*	*	*	*	*			
GW-2A	*	*	*	*	*	*		*	*
GW-3	*								
GW-4	*	*	*	*	*	*			
GW-5	*								
GW-6	*	*	*	*	*	*			
GW-7	*	*	*	*	*	*	*		
GW-8	*	*	*	*	*	*			
GW-10	*	*	*	*	*	*			
GW-11	*	*	*	*	*	*	*		
GW-12	*								
GW-13	*	*	*	*	*	*	*		
GW-14	*								
GW-15	*	*	*	*	*	*	*		
GW-16	*								
GW-17S	*								
GW-17D	*	*	*	*	*	*			
GW-18S	*								
GW-18D	*								
GW-19S	*	*	*	*	*	*			
GW-19D	*	*	*	*	*	*			
GW-20	*								
GW-21	*								
GW-22S	*	*	*	*	*	*			
GW-22D	*	*	*	*	*	*	*		
GW-23	*								
GW-24	*	*	*	*	*	*			
GW-25	*	*	*	*	*	*			
GW-26	*	*	*	*	*	*			

SURFACE WATER

	Flow Measurements	Inorganics						Organics	
		Cl	SO_4	NH_3	S.C.	pH	Cr^{+3}	DOP	N-N
SS-1	*	*	*	*	*	*		*	*
SS-2	*								
SS-5	*	*	*	*	*	*	*	*	
SS-11	*								
SS-12	*	*	*	*	*	*			
SS-16	*	*	*	*	*	*		*	*

TABLE V-2

1983 MONITORING SCHEDULE
GROUND WATER

	Ground-Water Measurements	Inorganics Cl	SO_4	NH_3	S.C.	pH	Organics DOP	N-N
GW-1	*							
GW-2A	*	*	*	*	*	*	*	*
GW-3	*							
GW-4	*		*	*	*	*		
GW-5	*							
GW-6	*	*	*	*	*	*		
GW-7	*							
GW-8	*							
GW-10	*							
GW-11	*	*	*	*	*	*		
GW-12	*							
GW-13	*			*	*	*		
GW-14	*							
GW-15	*			*	*	*		
GW-16	*							
GW-17S	*							
GW-17D	*							
GW-18S								
GW-18D								
GW-19S	*		*	*	*	*		
GW-19D	*	*	*	*	*	*		
GW-20								
GW-21	*							
GW-22S	*							
GW-22D	*							
GW-23	*							
GW-24	*							
GW-25	*	*	*	*	*	*		
GW-26	*	*	*	*	*	*		

SURFACE WATER

	Flow Measurements	Inorganics Cl	SO_4	NH_3	S.C.	pH	Organics DOP
SS-1	*	*	*	*	*	*	
SS-5	*	*	*	*	*	*	*
SS-12	*	*	*	*	*	*	
SS-16	*	*	*	*	*	*	*

MALCOLM PIRNIE

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APPENDIX A

BORING LOGS

APPENDIX A

SOIL BORING AND MONITORING WELL INSTALLATION

The drilling work was done by Soil Exploration Corporation, of Stow, Massachusetts. In six of the wells, soil borings were performed first, using a 2½ inch hollow stem auger down to bedrock, sampling with a two-inch split spoon. All sampling was performed according to ASTM D 1586-67 specifications. Four to ten feet of bedrock were then cored using NX core. After coring, the bedrock core hole was backfilled with a cement-bentonite slurry. In the four shallow wells, each boring was augered down without sampling to the level at which the well point would be set. A monitoring well was then installed in each of the borings.

The monitoring wells are constructed as follows. Two-inch Schedule 80 flush-jointed, vented PVC pipe with a five foot, 0.01 inch machine-slotted screen was used. The area around the screen was backfilled to at least one foot above the screen with a uniform medium sand. The well was then grouted to the surface with a cement-bentonite slurry. A five-foot long, six-inch diameter protective steel casing with a locking cap, set into a concrete collar, was then placed around each well.

The recovery well was constructed of 12-inch diameter PVC, perforated with ½-inch holes every foot. After excavation with a backhoe, two inches of gravel was placed on the bottom of the hole. The well was set on this gravel layer, then backfilled with additional gravel. A cover and a grating were placed over the well head.

GW-2 was replaced with a six-inch diameter Schedule 80 well with a five foot, 0.01 slot, machine-slotted screen, after the area was excavated with a backhoe. The area around the screen was backfilled with clean sand, then grouted near the surface. A concrete collar was installed around the well head.

The well is constructed of four-inch diameter steel casing with a five-foot 1½-inch drive point. A small area was excavated with a backhoe, then the well was driven into the bottom of the pit and backfilled with the excavated material. The well head is capped.

The drive point wells were made of 1½-inch galvanized steel with five-foot aluminum wrapped screens. The wells were driven in using a jack hammer, then capped with a screw cap.

BORING GW-17D

PROJECT: Olin-Wilmington	PROJECT NO: 284-10-1E00
DATE: 3/3/81	LOCATION: Wilmington, MA
DRILLING CONTRACTOR: Soil Exploration	INSPECTOR: CA Kraemer
DRILLING METHOD: 2½" hollow stem augers	SAMPLING METHOD: 2" split spoon 300 lb. hammer with 24" drop
ELEVATION:	DATUM:

SAMPLE no.	depth	blows per 6"		DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
S-1	0'-2'	1	0			very loose, brown, PEAT, little sand, wet		
		1	0					
S-2	2'-4'	7	11			medium dense, brown, SILT and fine SAND, trace clay, wet		
		15	12					
S-3	4'-6'	9	15	5				
S-4	6'-8'	19	20			Dense, brown-gray, fine to coarse SAND, little silt, trace gravel, wet		
		25	10					
S-5	8'-9.5'	15	100			very dense, gray/brown, SAND, some silts, some gravel, wet, GLACIAL TILL		
		70		10				
						Top of Rock, 13.0 feet		
						Run 1 13.0'-18.0', run 5.0 feet, recover 4.8 feet, 96% recovery		
				15				
						Run 2 18.0'-23.0', run 5.0 feet, recover 3.5, 70% recovery		
				20		Bottom of boring, 23.0 feet		
				25				
				30				
				35				

NOTES: Monitoring well installed. Cement-bentonite slurry from 13.0 to 23.0'. Tip of 5.0 foot 0.010-inch machine slotted well screen set at 12 feet and backfilled with uniform medium sand to 7.0 feet. Cement-benton slurry from 7.0 feet to ground surface. 5-foot long 6-inch diameter prot tive steel sleeve, with locking cap, placed on top.

MALCOLM PIRNIE INC

BORING GW-17S

PROJECT: Olin-Wilmington	PROJECT NO: 284-10-1E00
DATE: 3/4/81	LOCATION: Wilmington, MA
DRILLING CONTRACTOR: Soil Exploration	INSPECTOR: CA Kraemer
DRILLING METHOD: 2½" hollow stem augers	SAMPLING METHOD: None taken
ELEVATION:	DATUM:

SAMPLE no.	SAMPLE depth	blows per 6"	DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
			5				
					Bottom of boring 8.0 feet		
			10				
			15				
			20				
			25				
			30				
			35				

NOTES: Monitoring well installed. Tip of 5.0 foot 0.010-inch machine slotte well screen set at 8.0 feet and backfilled with medium uniform sand to 2.0 feet. Cement-bentonite slurry from 2.0 feet to ground surface 5-foot long 6-inch diameter protective steel sleeve, with locking cap placed on top.

MALCOLM PIRNIE INC.

BORING GW-18D

PROJECT: Olin-Wilmington	PROJECT NO: 284-10-1E00
DATE: 2/24/81	LOCATION: Wilmington, MA
DRILLING CONTRACTOR: Soil Exploration	INSPECTOR: CA Kraemer
DRILLING METHOD: 2½" hollow stem augers	SAMPLING METHOD: 2" split spoon 300 lb. hammer with 24" drop
ELEVATION:	DATUM:

SAMPLE no.	SAMPLE depth	blows per 6"		DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
S-1	0'-2'	1	0			Very loose, brown, PEAT and SAND, moist		
S-2	2'-4'	12	15			Very dense, tan SAND, some gravel, some silt, moist		
		20	20					
S-3	4'-5'	15	31	5				
S-4	6'-8'	12	24			Very dense, brown/gray, SAND some gravel, some silt, wet, GLACIAL TILL		
		21	22					
S-5	8'-10'	30	28					
		20	20	10				
S-6	11'-13'	11	30					
		50	40					
				15				
				20		Top of rock, 19.9 feet Run 1 20.0 to 25.0 feet, run 5.0 feet recover 3.5 feet 70% recovery		
				25		Run 2 25.0'-26.0', Run 1.0 foot Recover 0.0 feet, 0% recovery		
				30		Bottom of boring, 26.0 feet		
				35				

NOTES: Monitoring well installed. Cement-bentonite slurry from 20.0' to 26.0'. Tip of 5.0 foot 0.010-inch machine slotted well screen set at 19.5feet and backfilled with medium uniform sand. Cement-bentonite slurry from 10.0 feet to ground surface. 5-foot long 6-inch diameter protective steel sleeve, with locking cap, placed on top.

BORING GW-18S

PROJECT: Olin-Wilmington	PROJECT NO: 284-10-1E00
DATE: 2/25/81	LOCATION: Wilmington, MA
DRILLING CONTRACTOR: Soil Exploration	INSPECTOR: CA Kraemer
DRILLING METHOD: 2½" hollow stem augers	SAMPLING METHOD: None taken
ELEVATION:	DATUM:

SAMPLE no.	SAMPLE depth	blows per 6"	DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
			5				
			10		Bottom of boring 10.0 feet		
			15				
			20				
			25				
			30				
			35				

NOTES: Monitoring well installed. Tip of 5.0 foot 0.010-inch machine slot well screen set at 10.0 feet and backfilled with medium uniform sand to 3.0 feet. Cement-bentonite slurry from 3.0 feet to ground surface 5-foot long 6-inch diameter protective steel sleeve, with locking cap placed on top.

BORING GW-19D

PROJECT: Olin-Wilmington	PROJECT NO: 284-10-1E00
DATE: 2/9/81	LOCATION: Wilmington, MA
DRILLING CONTRACTOR: Soil Exploration	INSPECTOR: CA Kraemer
DRILLING METHOD: 2½" hollow stem augers	SAMPLING METHOD: 2" split spoon 300 lb. hammer with 24" drop
ELEVATION:	DATUM:

SAMPLE no.	SAMPLE depth	blows per 6"		DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
						Dense, brown, SILT and SAND, little gravel, frozen, FILL		
S-1	2'-4'	1	0			Very loose, light gray, SILT, wet, GYPSUM SLUDGE		
		0	0					
S-2	4'-6'	1	0					
		0	0	5				
S-3	6'-7.5'	1	1			Very loose, brown, SILT and SAND, some organics, wet		
S-4	7.5'-9.0'	2	2					
		2	12					
S-5	9'-10'	8	100	10		Grading to little gravel		
						Very dense brown/gray, SAND and gravel, little silt, wet, GLACIAL TILL		
S-6	11'-12.5'	12	25					
S-7	12.5'-13.3'	35	15					
		100/	.3'					
S-8	14'-14.8'	30		15				
		100/	.3'			Boulder 15'-16.1'		
						Boulder, 16.5'-17.1' and 17.1'-17.8'		
						Boulder 18'-18.8' and 19.3'-19.9'		
						Top of rock 20.0 feet		
				20		Run 1 20.0'-23.0' run 3.0 feet		
						Recover 2.0 feet, 67% recovery		
						Run 2 23.0'-24.3' Run 1.3 feet		
						Recover 0.0 feet 0% recovery		
				25		(Core barrel broke)		
						Bottom of boring 24.3 feet		
				30				
				35				

NOTES: Monitoring well installed. Cement-bentonite slurry from 20.0' to 24.3'. Tip of 5.0 foot 0.010-inch machine slotted well screen set at 19.7 feet and backfilled with medium uniform sand to 10.0 feet. Cement bentonite slurry from 10.0 feet to ground surface. 5-foot long 6-inch protective steel sleeve, with locking cap, placed on top.

BORING GW-19S

PROJECT: Olin-Wilmington	PROJECT NO: 284-10-1E00
DATE: 2/12/81	LOCATION: Wilmington, MA
DRILLING CONTRACTOR: Soil Exploration	INSPECTOR: CA Kraemer
DRILLING METHOD: 2½" hollow stem augers	SAMPLING METHOD: None taken
ELEVATION:	DATUM:

SAMPLE no.	SAMPLE depth	blows per 6"	DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
			5				
			10		Bottom of boring 10.0 feet		
			15				
			20				
			25				
			30				
			35				

NOTES: Monitoring well installed. Tip of 5.0 foot 0.010-inch machine slot well screen set at 10.0 feet and backfilled with medium uniform sand to 3.5 feet. Cement-bentonite slurry from 3.5 feet to ground surface 5-foot long 6-inch diameter protective steel sleeve, with locking cap placed on top.

BORING GW-20

PROJECT: Olin-Wilmington	PROJECT NO: 284-10-1E00
DATE: 2/26/81	LOCATION: Wilmington, MA
DRILLING CONTRACTOR: Soil Exploration	INSPECTOR: CA Kraemer
DRILLING METHOD: 2½" hollow stem augers	SAMPLING METHOD: 2" split spoon 300 lb. hammer with 24" drop
ELEVATION:	DATUM:

SAMPLE no.	depth	blows per 6"		DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
~~S-1~~	~~0'-2'~~	1	0			Top soil and roots, 0.0'-1.0 feet		
		4	12			Medium dense, brown, SAND, some gravel, trace silt, moist Grading to dense, SAND and GRAVEL trace silt		
~~S-2~~	2'-4'	25	23					
		17	15					
S-3	4'-5.5'	10	18					
		40		5		Very dense, gray/brown, SAND some silt, some gravel, moist, GLACIAL TILL		
				10				
				15		Top of Rock 15.0 feet Run 1, 15.0'-16.5' Run 15. feet Recover 1.0', 67% recovery Run 2, 16.5'-21.5' Run 5.0' Recover 3.9', 68% recovery		
				20				
						Bottom of boring 21.5 feet		
				25				
				30				
				35				

NOTES: Monitoring well installed. Cement-bentonite slurry from 15.0' to 21.5' Tip of 5.0 foot 0.010-inch machine slotted well screen set at 14.7' feet and backfilled with medium uniform sand to 8.0 feet. Ceme bentonite slurry from 8.0 feet to ground surface. 5-foot long 6-inch diameter protective steel sleeve, with locking cap, placed on top.

PROJECT: Olin-Wilmington	PROJECT NO: 284-10-1E00
DATE: 3/5/81	LOCATION: Wilmington, MA
DRILLING CONTRACTOR: Soil Exploration	INSPECTOR: CA Kraemer
DRILLING METHOD: 2½" hollow stem augers	SAMPLING METHOD: 2" split spoon 300 lb. hammer with 24" drop
ELEVATION:	DATUM:

SAMPLE no.	SAMPLE depth	blows per 6"		DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
S-1	0'-2'	1	0			Very loose, dark brown, PEAT, little sand, wet		
		0	0					
S-2	2'-4'	5	6			Medium dense, brown, SAND, trace silt, wet		
		5	6					
S-3	4'-6'	9	11	5		Dense, brown/gray SAND, some SILT, some gravel, moist GLACIAL TILL		
		12	11					
				10				
				15		Top of Rock 15.0 feet Run 1, 15.0'-17.5' Run 2.5' Recover 2.5', 100% recovery Run 2, 17.5'-20.0' recover 2.0' 80% recovery		
				20		Bottom boring, 20.0 feet		
				25				
				30				
				35				

NOTES: Monitoring well installed. Cement-bentonite slurry from 15.0' to 20.0' Tip of 5.0 foot 0.010-inch machine slotted pipe well screen set at 14.5' feet and backfilled with uniform medium sand to 4.0 feet. Cement-bentonite slurry from 4.0 feet to ground surface. 5-foot long : inch protective steel sleeve, with locking cap, placed on top.

BORING GW-22D

PROJECT: Olin-Wilmington	PROJECT NO: 284-10-1E00
DATE: 3/4/81	LOCATION: Wilmington, MA
DRILLING CONTRACTOR: Soil Exploration	INSPECTOR: CA Kraemer
DRILLING METHOD: 2½" hollow stem augers	SAMPLING METHOD: 2" split spoon 300 lb. hammer with 24" drop
ELEVATION:	DATUM:

SAMPLE no.	SAMPLE depth	blows per 6"	blows per 6"	DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
S-1	0'-2'	1	2			Loose, brown, SAND, trace silt, wet, MISCELLANEOUS FILL (also contains construction lumber, metal strips, and chemical products)		
		5	6					
S-2	2'-4'	6	5					
		4	4					
S-3	4'-6'	3	2					
		7	8	5				
S-4	6'-8'	8	9					
		14	28					
S-5	8'-10'	8	9					
		14	28					
S-6	10'-12'	23	26	10		Dense brown, fine SAND, little gravel, little silt, wet		
		18	21					
S-7	12'-14'	14	21					
		25	26					
S-8	14'-16'	24	25					
		19	19	15		Dense gray/brown, SAND, some silt, some gravel, moist, GLACIAL TILL		
				20				
				25				
				30				
				35		Top of Rock 36.0 feet Bottom of boring, 36.0 feet		

NOTES: Monitoring well installed. Tip of 5.0 foot 0.010-inch machine slott well screen set at 35.0 feet and backfilled with uniform medium sand to 15.0 feet. Cement-bentonite slurry from 15.0 feet to ground surface 5-foot long 6-inch diameter protective steel sleeve, with locking cap placed on top.

BORING GW-22S

PROJECT: Olin-Wilmington	PROJECT NO: 284-10-1E00
DATE: 3/5/81	LOCATION: Wilmington, MA
DRILLING CONTRACTOR: Soil Exploration	INSPECTOR: CA Kraemer
DRILLING METHOD: 2½" hollow stem augers	SAMPLING METHOD: None taken
ELEVATION:	DATUM:

SAMPLE no.	SAMPLE depth	blows per 6"		DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
				5				
				10				
				15		Bottom of boring 15.0 feet		
				20				
				25				
				30				
				35				

NOTES: Monitoring well installed. Tip of 5.0 foot 0.010-inch machine slot well screen set at 15.0 feet and backfilled with medium uniform sand to 8.0 feet. Cement-bentonite slurry from 8.0 feet to ground surface 5-foot long 6-inch diameter protective steel sleeve, with locking cap placed on top.

APPENDIX B

LABORATORY SOIL TEST PROCEDURES

OLIN, WILMINGTON

SUMMARY OF SOILS LABORATORY TEST RESULTS

Boring No.	Sample No.	Depth	Moisture Content (%)	pH	Cation Exchange Capacity (meg/100g)	Soil Description
GW-17D	S-2	2'-4'	14	5.2	5.2	SAND, little silt, trace gravel
GW-17D	S-4	6'-8'	8	6.7	22.7	SAND, some silt, some gravel, SM[1], TILL
GW-18D	S-2	2'-4'	9	4.9	28.2	SAND, some gravel, some silt, SM[1]
GW-18D	S-4	6'-8'	10	5.2	21.5	SAND, some gravel, some silt, TILL
GW-18D	S-6	11'-13'	9	6.7	22.8	SAND, some silt, some gravel, SM[1], TILL
GW-19D	S-6	11'-12.5'	10	5.7	18.6	SAND and GRAVEL, little silt, SM[1], TILL
GW-20	S-2	2'-4'	10	4.7	8.8	SAND, some gravel, trace silt, SM-SP[1]
GW-21	S-2	2'-4'	24	4.3	13.5	SAND, trace silt, SM-SP[1]
GW-22D	S-3	4'-6'	20	7.5	7.1	SAND, trace silt, SP[1]
GW-22D	S-6	10'-12'	12	6.9	5.1	SAND, little silt, little gravel, SM[1]
GW-22D	S-7	12'-14'	10	6.3	7.2	SAND, some silt, some gravel, TILL

1 Unified Soil Classification System

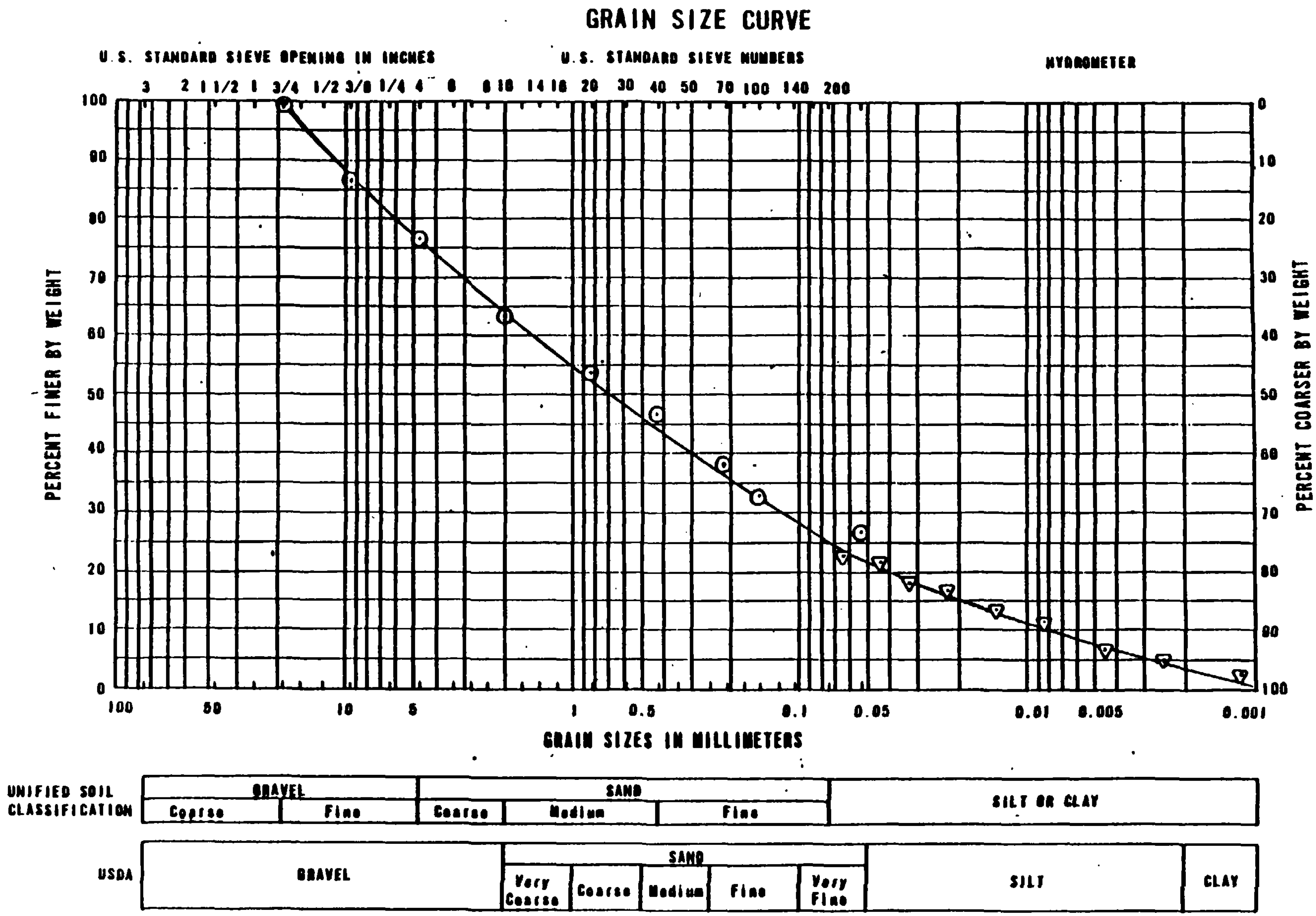
APPENDIX B
LABORATORY SOIL TEST PROCEDURES

1. Moisture Content: ASTM D 2216-71

2. Grain-size distribution: ASTM D 422-63

3. pH: Glass electrode pH meter

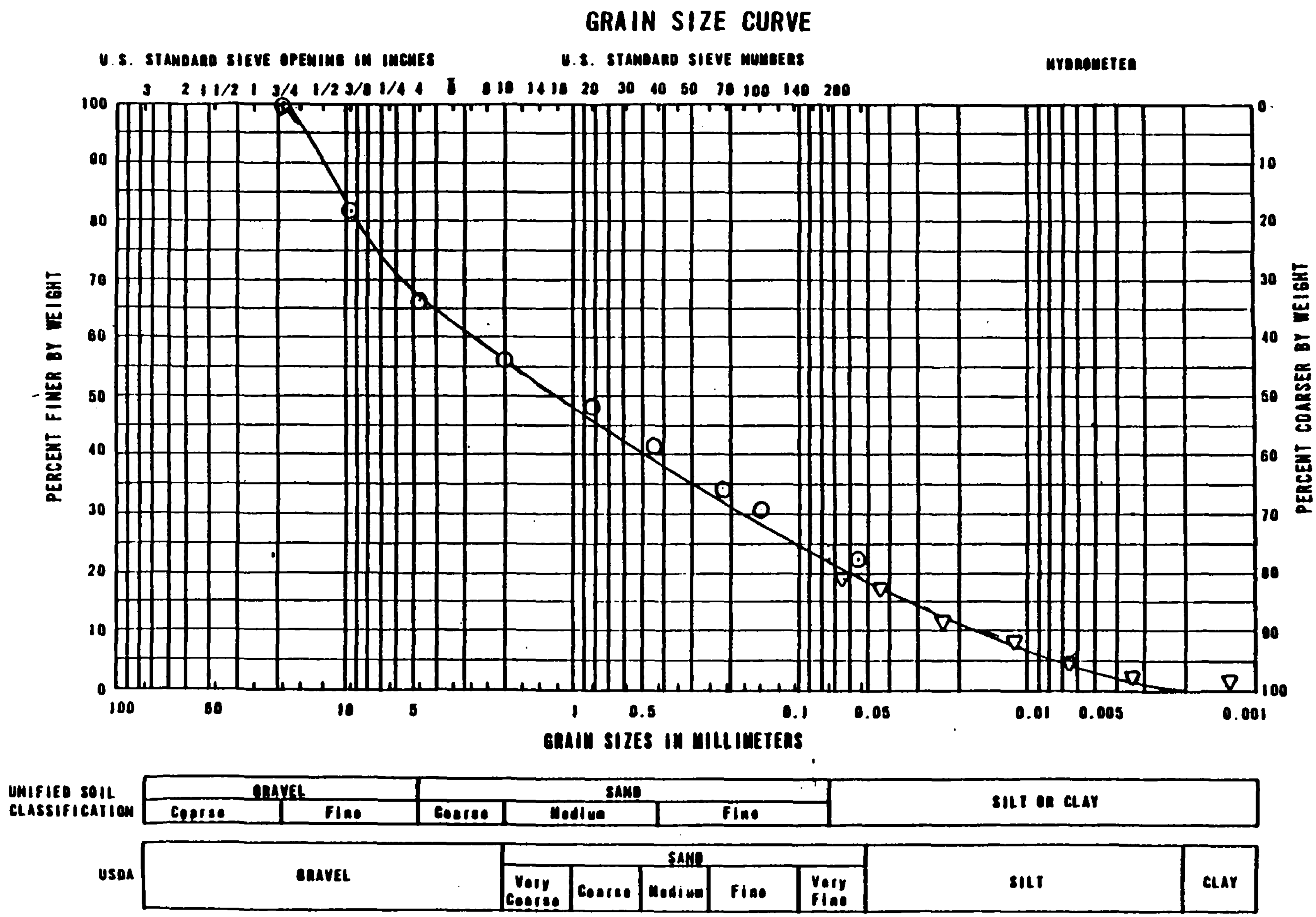
4. CEC: Sodium extraction method



MALCOLM PIRNIE INC.

Olin-Wilmington
284-10-1E00
GW-17
S-4

Figure B-2

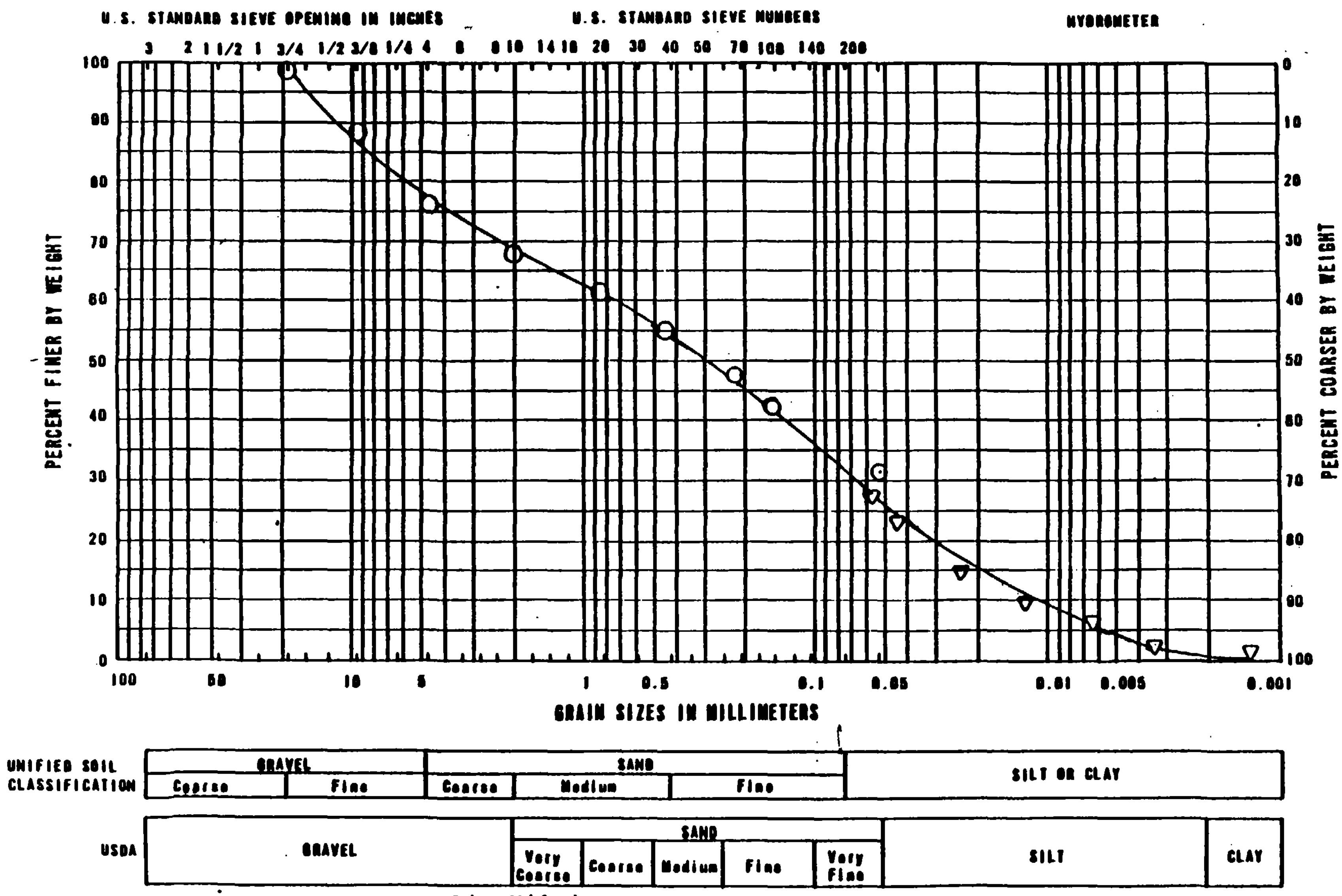


MALCOLM PIRNIE INC.

Olin-Wilmington
284-10-1E00
GW-18
S-2

Figure B-3

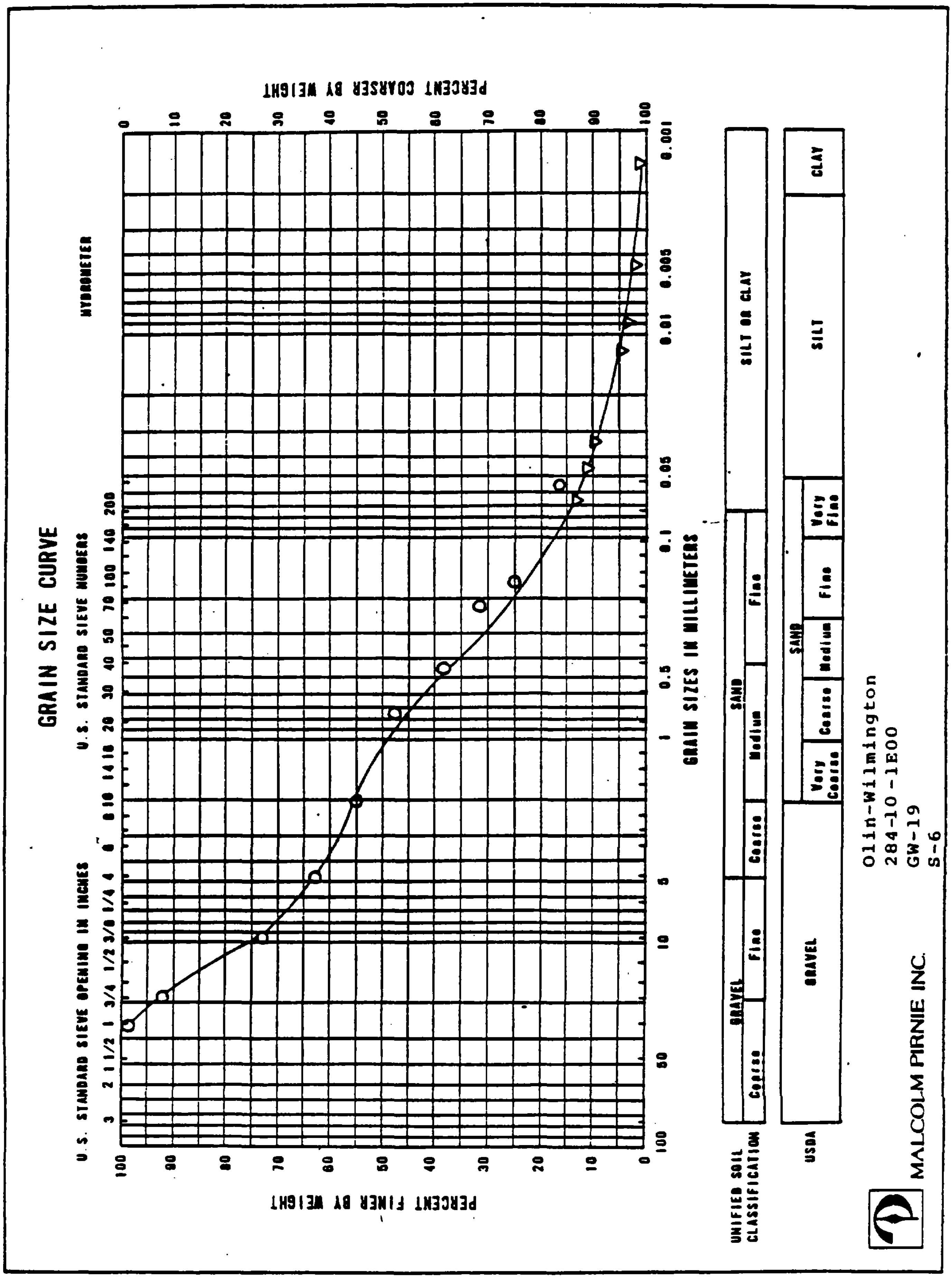
GRAIN SIZE CURVE



Olin-Wilmington
284-10-1E00
GW-18
S-6

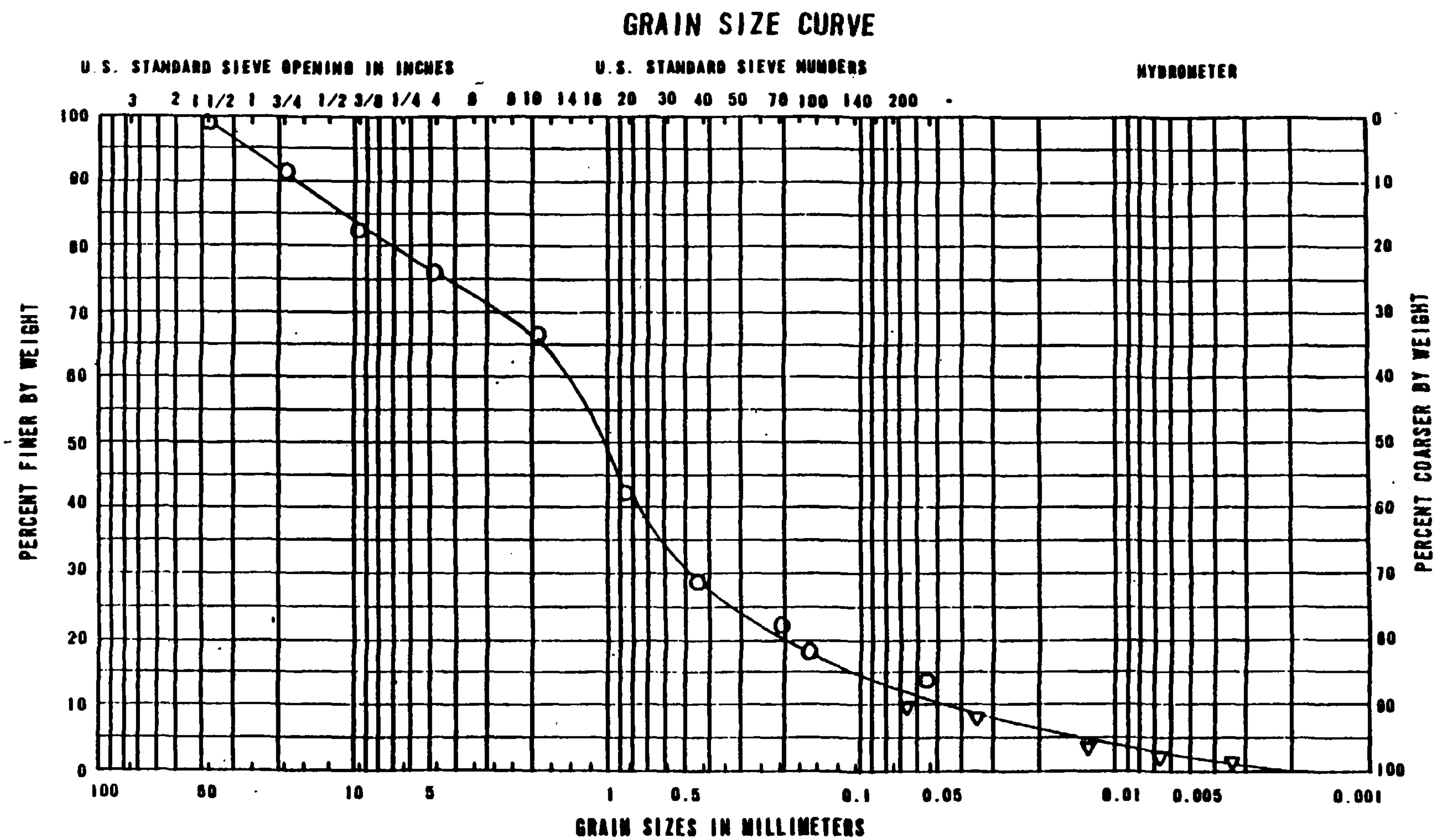
MALCOLM PIRNIE INC.

Figure B-4



GRAIN SIZE CURVE
U.S. STANDARD SIEVE OPENING IN INCHES
3 2 1 1/2 1 3/4 1/2 3/8 1/4 4
U.S. STANDARD SIEVE NUMBERS
6 8 10 14 16 20 30 40 50 70 100 140 200
HYDROMETER
PERCENT FINER BY WEIGHT
PERCENT COARSER BY WEIGHT
GRAIN SIZES IN MILLIMETERS
100 50 10 5 1 0.5 0.1 0.05 0.01 0.005 0.001
UNIFIED SOIL CLASSIFICATION
GRAVEL
Coarse
Fine
SAND
Coarse
Medium
Fine
SILT OR CLAY
USDA
GRAVEL
SAND
Very Coarse
Coarse
Medium
Fine
Very Fine
SILT
CLAY
Olin-Wilmington
284-10-1E00
GW-19
S-6
MALCOLM PIRNIE INC.

Figure B-5



UNIFIED SOIL CLASSIFICATION	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

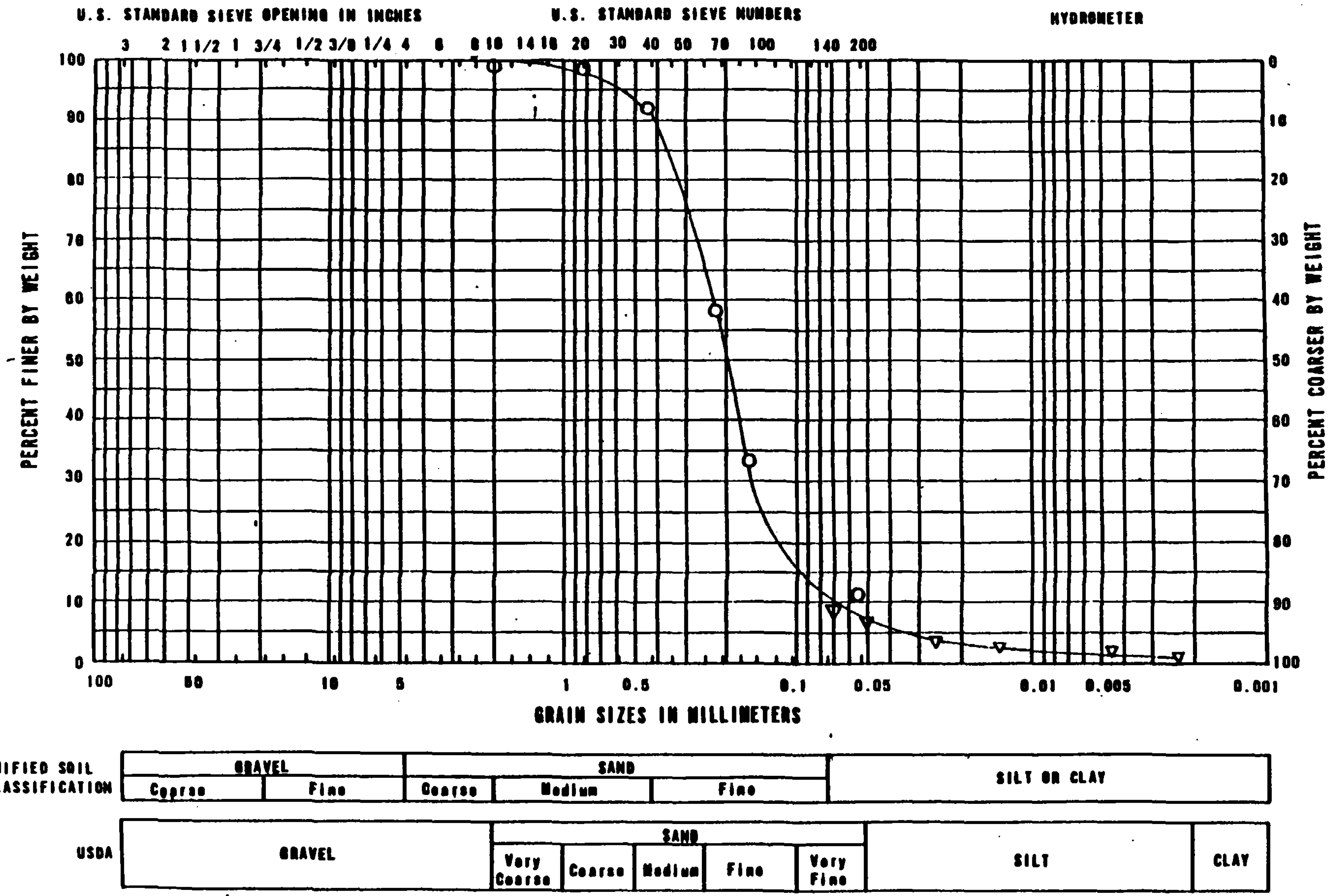
USDA	GRAVEL	SAND					SILT	CLAY
		Very Coarse	Coarse	Medium	Fine	Very Fine		

MALCOLM PIRNIE INC.

Olin-Wilmington
284-10-1E00
GW-20
S-2

Figure B-6

GRAIN SIZE CURVE

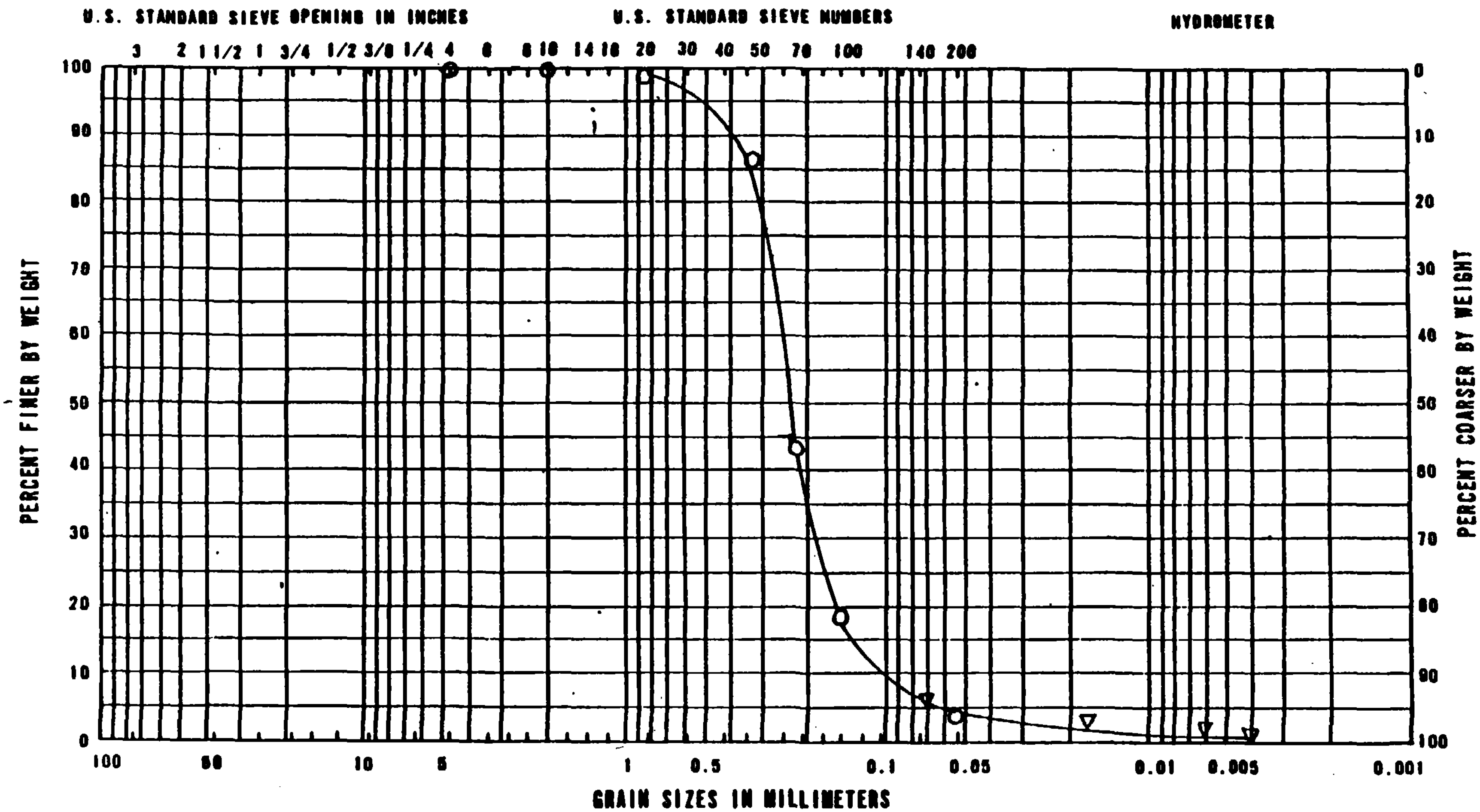


MALCOLM PIRNIE INC.

Olin Wilmington
284-10-1E00
GW-21
S-2

Figure B-7

GRAIN SIZE CURVE



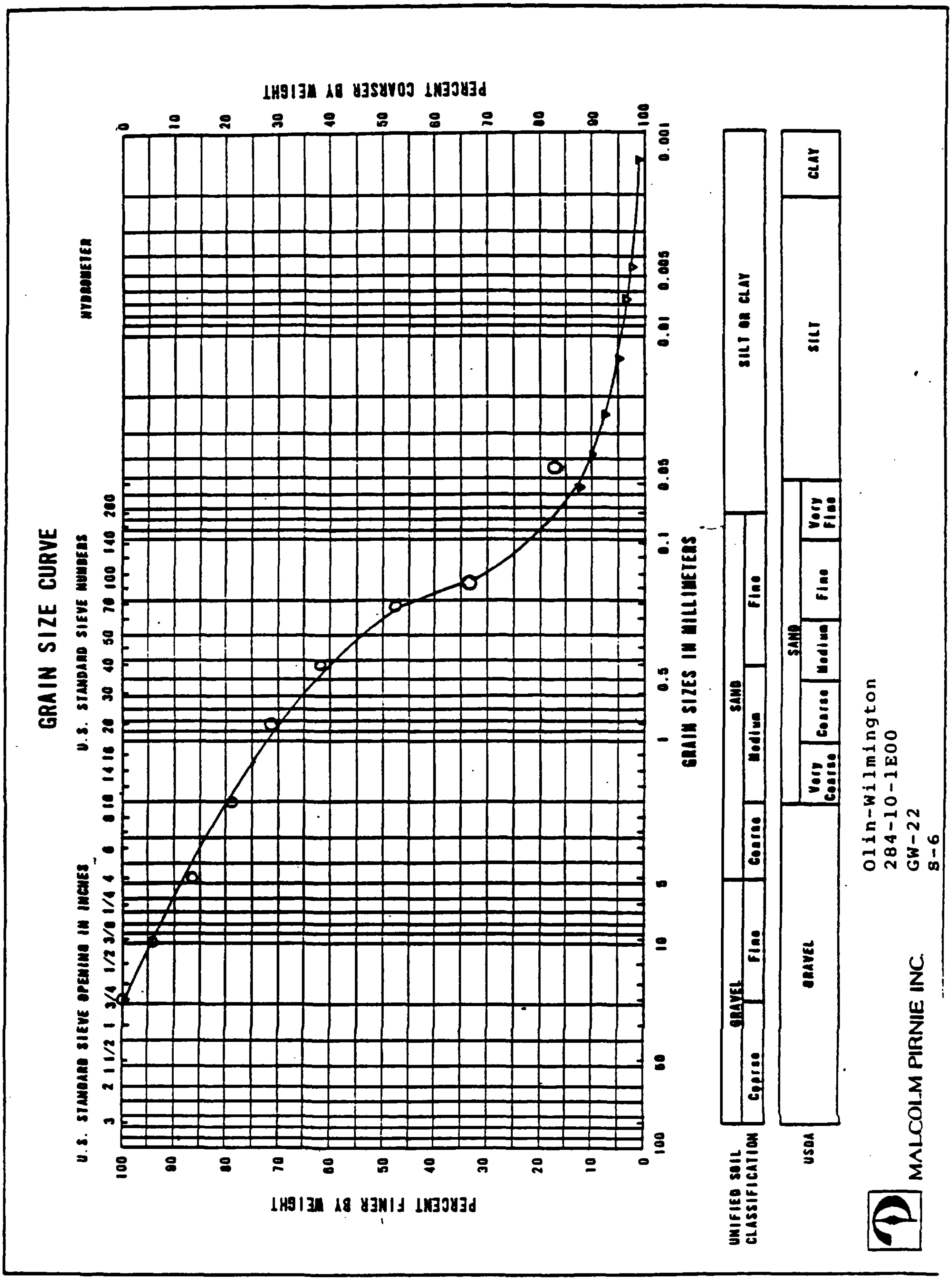
UNIFIED SOIL CLASSIFICATION	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

USDA	GRAVEL	SAND					SILT	CLAY
		Very Coarse	Coarse	Medium	Fine	Very Fine		

MALCOLM PIRNIE INC.

Olin Wilmington
284-10-1E00
GW-22
S-3

Figure B-8


GRAIN SIZE CURVE
U.S. STANDARD SIEVE OPENING IN INCHES
U.S. STANDARD SIEVE NUMBERS
HYDROMETER
3 2 1 1/2 1 3/4 1/2 3/8 1/4 4 6 8 10 14 16 20 30 40 50 70 100 140 200
PERCENT FINER BY WEIGHT
PERCENT COARSER BY WEIGHT
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
100 50 10 5 1 0.5 0.1 0.05 0.01 0.005 0.001
GRAIN SIZES IN MILLIMETERS
UNIFIED SOIL CLASSIFICATION
GRAVEL
Coarse
Fine
SAND
Coarse
Medium
Fine
SILT OR CLAY
USDA
GRAVEL
SAND
Very Coarse
Coarse
Medium
Fine
Very Fine
SILT
CLAY
Olin-Wilmington
284-10-1E00
GW-22
S-6
MALCOLM PIRNIE INC.

APPENDIX B

LABORATORY SOIL TEST PROCEDURES

TABLE B-1

HYDRAULIC CONDUCTIVITIES OF SOILS BENEATH THE OLIN SITE

WELL	HYDRAULIC CONDUCTIVITY, CM/SEC	SOIL TYPE
GW-1	2×10^{-2}	till
GW-2	9×10^{-3}	sand and till
GW-3	2×10^{-4}	sand and till
GW-4	5×10^{-4}	till
GW-5	6×10^{-3}	till
GW-6	1×10^{-4}	sand and till
GW-7	2×10^{-4}	till
GW-8	2×10^{-2}	till, little sand
GW-10	1×10^{-2}	sand and till
GW-11	5×10^{-4}	sand
GW-12	4×10^{-3}	sand, little till

APPENDIX C

INORGANIC CHEMICAL ANALYSES-GROUND WATER

APPENDIX C
PHYSIOCHEMICAL MEASUREMENTS

pH was measured using a Universal Interloc pH meter. The pH was measured from a sample of fresh well water (after well evacuation) or surface water. The pH meter was standardized after every third pH reading with pH 4 standard solution and pH 10 standard solution.

Disolved oxygen was measured in milligrams per liter (mg/l) with a Yellow Springs dissolved oxygen-temperature meter. The D.O. probe was placed in the well after well evacuation or below the stream surface for measurement. Standardization of the probe was performed after every third measurement, following the standardization procedure on the D.O. meter. The D.O. membrane on the probe was replaced before each sampling period.

Specific conductance was measured in micromhos (umhos) using a Hach spectrophotometer. Standardization of the meter was performed in the Pirnie laboratory before the beginning of each sampling period. Samples were taken from fresh well water (after well evacuation) or surface water.

Temperature was measured in degrees centigrade (°C) with the temperature probe on the dissolved oxygen meter, in the well or stream; and with a field thermometer measured in a fresh sample drawn from the well or stream.

<u>Inorganic Analysis Techniques</u>

1.	Cl^-	Titrimetric; Mercuric Nitrate
2.	$SO_4^=$	Gravimetric; Turbidimetric
3.	NH_3-N	Colorimetric; Distillation Procedure
4.	NO_3-NO_2-N	Colorimetric; Brucine, Spectrophotometric

5.	Total Cr	Atomic Absorption; Chelation-Extraction
6.	Cr^{3+}	Total Cr - hexavalent Cr
7.	Cr^{6+}	Chelation-Extraction
8.	Cd	Atomic Absorption; Direct Aspiration
9.	Pb	Atomic Absorption; Direct Aspiration
10.	Alkalinity	Titrimetric (pH 4.5)

TABLE C-1

PHYSIOCHEMICAL CHARACTERISTICS OF GROUND WATER AT WILMINGTON

Well Number	Specific Conductance, umhos 3-81	4-81	5-81	6-81	8-81	12-81
GW-1	475	575	725	600	869	-
GW-2 & 2A	6,750	10,500	1,650	52,000	1,000	1,050
GW-3	1,200	1,100	1,125	2,250	1,225	-
GW-4	3,750	3,000	3,500	6,500	4,000	6,250
GW-5	5,750	4,250	5,000	5,000	3,500	4,975
GW-6	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
GW-7	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
GW-8	4,300	3,800	3,800	5,500	7,000	-
GW-10	200	1,275	500	2,250	2,968	-
GW-11	1,550	18,500	12,500	14,000	15,750	8,500
GW-12	525	725	480	575	550	-
GW-13	3,250	550	160	125	170	-
GW-14	325	500	600	825	851	-
GW-15	3,500	4,250	4,000	5,750	4,500	-
GW-16	550	275	250	375	650	-
GW-17S	-	2,500	2,500	3,500	4,000	-
GW-17D	7,000	7,000	7,250	9,000	8,000	-
GW-18S	-	-	-	-	-	-
GW-18D	-	9,750	1,550	1,425	950	-
GW-19S	3,000	3,250	3,500	3,500	3,700	-
GW-19D	5,500	3,250	6,000	11,500	15,500	-
GW-20	1,150	1,275	1,875	900	900	-
GW-21	625	950	1,525	1,600	1,750	-
GW-22S	13,750	10,250	8,500	9,000	12,757	-
GW-22D	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
GW-23	-	-	-	-	750	-
GW-24	-	-	-	-	13,250	-
GW-25	-	-	-	-	16,000	-
GW-26	-	-	-	-	13,500	17,500

TABLE C-2

PHYSIOCHEMICAL CHARACTERISTICS OF GROUND WATER AT WILMINGTON

Well Number	pH					
	3-81	4-81	5-81	6-81	8-81	12-81
GW-1	6.0	6.2	6.2	6.4	6.2	-
GW-2 & 2A	6.2	5.1	5.3	-	6.5	5.6
GW-3	[redacted]	5.1	5.9	6.1	4.6	-
GW-4	[redacted]	5.3	5.1	5.4	5.1	6.3
GW-5	6.4	6.1	6.5	6.4	6.0	6.5
GW-6	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
GW-7	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
GW-8	[redacted]	[redacted]	[redacted]	5.2	[redacted]	-
GW-10	[redacted]	4.1	[redacted]	6.4	5.5	-
GW-11	10	9.5	9.0	9.4	9.0	7.3
GW-12	5.3	4.9	6.2	6.6	5.4	-
GW-13	6.8	5.1	6.9	7.2	6.3	-
GW-14	6.5	4.9	6.5	6.6	5.8	-
GW-15	6.5	4.8	6.6	7.0	7.1	-
GW-16	6.8	4.4	6.2	5.9	5.5	-
GW-17S	-	6.4	6.1	6.6	5.6	-
GW-17D	6.8	6.0	5.6	5.8	5.9	-
GW-18S	-	-	-	-	-	-
GW-18D	-	11.3	10	9.9	10.4	-
GW-19S	9.5	5.7	5.9	6.4	5.9	-
GW-19D	5.8	6.5	5.5	6.8	6.7	-
GW-20	10.8	10.4	10.4	9.3	10.5	-
GW-21	6.7	5.4	6.8	6.7	6.7	-
GW-22S	9.5	7.6	8.2	7.9	7.6	-
GW-22D	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
GW-23	-	-	-	-	6.1	-
GW-24	-	-	-	-	6.8	-
GW-25	-	-	-	-	6.5	-
GW-26	-	-	-	-	4.3	5.1

TABLE C-3

PHYSIOCHEMICAL CHARACTERISTICS OF GROUND WATER AT WILMINGTON

Well Number	Chlorides, mg/l 3-81	4-81	5-81	6-81	8-81	12-81
GW-1	72	107	77	123	135	-
GW-2	[redacted]	950	194	-	110	30
GW-3	36	27	26	61	42	-
GW-4	416	438	449	459	465	455
GW-5	450	480	459	490	370	394
GW-6	[redacted]	[redacted]	[redacted]	[redacted]	1899	-
GW-7	[redacted]	[redacted]	[redacted]	[redacted]	4950	-
GW-8	370	368	281	582	720	-
GW-10	18	11	10	230	250	-
GW-11	[redacted]	[redacted]	[redacted]	[redacted]	2524	819
GW-12	62	53	306	102	18	-
W-101						-
GW-13	253	11	10	[redacted]	10	-
GW-14	45	16	306	71	150	-
GW-15	541	512	449	766	340	-
GW-16	65	37	26	5	35	-
GW-17S	-	235	204	225	210	-
GW-17D	591	875	766	510	949	-
GW-18S	-	-	-	-	-	-
GW-18D	-	69	56	163	25	-
GW-19S	94	64	72	102	40	-
GW-19D	601	[redacted]	536	[redacted]	1999	-
GW-20	22	16	179	26	15	-
GW-21	94	107	87	112	110	-
GW-22S	300	480	378	434	730	-
GW-22D	[redacted]	[redacted]	[redacted]	[redacted]	7990	-
GW-23	-	-	-	-	70	-
GW-24	-	-	-	-	2000	-
GW-25	-	-	-	-	2074	-
GW-26	-	-	-	-	1399	1112
Sump-1	-	-	-	-	510	-

TABLE C-4

PHYSIOCHEMICAL CHARACTERISTICS OF GROUND WATER AT WILMINGTON

Well Number	Sulfates, mg/l 3-81	4-81	5-81	6-81	8-81	12-81
GW-1	44	28	100	55	36	-
GW-2	1,145	1,990	366	-	1,550	111
GW-3	405	402	384	725	362	-
GW-4	853	934	979	1,883	1,225	1,376
GW-5	1,523	1,500	1,400	2,767	1,075	1,446
GW-6	[redacted]	[redacted]	[redacted]	[redacted]	1,550	-
GW-7	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
GW-8	1,016	1,130	1,030	3,450	2,800	-
GW-10	32	23	27	767	590	-
GW-11	3,096	3,440	2,990	2,900	6,500	1,120
GW-12	54	101	70	64	33	-
GW-13	760	95	6	15	28	-
GW-14	44	35	16	106	80	-
GW-15	88	108	809	105	127	-
GW-16	38	30	20	26	19	-
GW-17S	-	930	863	1,500	875	-
GW-17D	2,215	3,045	2,624	2,624	6,520	3,500
GW-18S	-	-	-	-	-	-
GW-18D	-	60	326	178	122	-
GW-19S	1,726	1,675	1,774	2,530	1,350	-
GW-19D	1,228	1,839	1,265	6,080	3,400	-
GW-20	96	16	12	33	25	-
GW-21	100	64	17	6	11	-
GW-22S	2,911	2,620	1,880	4,330	4,050	-
GW-22D	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
GW-23	-	-	-	-	37	-
GW-24	-	-	-	-	4,250	-
GW-25	-	-	-	-	4,860	-
GW-26	-	-	-	-	8,500	7,729
Sump-1	-	-	-	-	2,145	-

TABLE C-5

PHYSIOCHEMICAL CHARACTERISTICS OF GROUND WATER AT WILMINGTON

Well Number	Alkalinity, mg/l 3-81	4-81	5-81	6-81	8-81	12-81
GW-1	54	83	98	89	-	-
GW-2 & 2A	0	28	88	-	-	160
GW-3	12	3	1	10	-	-
GW-4	2	6	0	9	-	4
GW-5	73	75	69	78	-	10
GW-6	0	122	0	148	-	-
GW-7	32	66	0	<1	-	-
GW-8	0	4	0	2	-	-
GW-10	2	2	0	28	-	-
GW-11	2725	3250	2765	3425	-	386
GW-12	41	5	3	<1	-	-
GW-13	67	21	15	17	-	-
GW-14	34	55	28	36	-	-
GW-15	554	700	738	1133	-	-
GW-16	89	28	6	20	-	-
GW-17S	-	50	34	70	-	-
GW-17D	-	215	170	102	-	-
GW-18S	-	-	-	-	-	-
GW-18D	-	300	180	335	-	-
GW-19S	311	263	122	236	-	-
GW-19D	246	506	238	955	-	-
GW-20	226	325	168	200	-	-
GW-21	32	242	195	132	-	-
GW-22S	1245	600	448	505	-	-
GW-22D	17	<1	0	<1	-	-
GW-23	-	-	-	-	-	-
GW-24	-	-	-	-	-	-
GW-25	-	-	-	-	-	-
GW-26	-	-	-	-	-	98

TABLE C-6

PHYSIOCHEMICAL CHARACTERISTICS OF GROUND WATER AT WILMINGTON

Well Number	NH_3-N, mg/l 3-81	4-81	5-81	6-81	8-81	12-81
GW-1	3	8	11	6	2	-
GW-2 & 2A	175	574	133	-	9	35
GW-3	46	75	29	48	36	-
GW-4	126	145	134	140	179	171
GW-5	125	176	157	134	114	129
GW-6	<1	3780	3878	5660	2489	-
GW-7	190	2638	3101	1318	3133	-
GW-8	158	226	210	384	377	-
GW-10	3	61	62	140	108	-
GW-11	729	1854	2051	2002	2458	476
GW-12	6	9	8	4	1	-
GW-13	130	26	11	7	5	-
GW-14	4	10	3	7	5	-
GW-15	167	182	135	333	350	-
GW-16	13	22	4	2	4	-
GW-17S	-	46	48	45	56	-
GW-17D	182	315	336	358	325	-
GW-18S	-	-	-	-	-	-
GW-18D	-	19	11	12	<1	-
GW-19S	83	114	126	130	108	-
GW-19D	239	609	353	974	1204	-
GW-20	1	11	21	1	1	-
GW-21	4	39	21	7	3	-
GW-22S	314	675	427	490	1081	-
GW-22D	192	4102	2757	2340	2545	-
GW-23	-	-	-	-	8	-
GW-24	-	-	-	-	1204	-
GW-25	-	-	-	-	1246	-
GW-26	-	-	-	-	991	126

TABLE C-7

PHYSIOCHEMICAL CHARACTERISTICS OF GROUND WATER AT WILMINGTON

Well Number	(NO_3+NO_2)-N, mg/l					
	3-81	4-81	5-81	6-81	8-81	12-81
GW-1	2.1	0.9	1.8	1.2	1.6	-
GW-2 & 2A	87.7	35.3	4.0	-	9.1	0.2
GW-3	8.7	13.3	14	26.9	16.8	-
GW-4	7.0	6.3	7.1	6.6	4.6	4.6
GW-5	12	8.9	7.5	0.1	0.8	1.5
GW-6	56.7	57.1	23.8	[redacted]	33.2	-
GW-7	42.4	21.7	31.5	43.2	34.6	-
GW-8	57.7	45.0	42.2	66.6	50.1	-
GW-10	6.9	8.4	8.8	16.0	12.4	-
GW-11	1.1	0.6	1.5	1.0	~~1~~.3	2.1
GW-12	3.0	2.6	0.5	4.6	2.5	-
GW-13	12.2	6.7	2.0	10.1	3.7	-
GW-14	4.6	4.8	0.6	7.7	4.1	-
GW-15	4.1	0.7	2.6	2.0	2.4	-
GW-16	0.2	2.8	2.6	5.8	3.7	-
GW-17S	-	6.1	3.2	1.6	3.0	-
GW-17D	7.5	9.2	8.7	20.2	13.0	-
GW-18S	-	-	-	-	-	-
GW-18D	-	10.6	11.3	15.2	11.9	-
GW-19S	1.0	1.3	2.2	3.0	2.4	-
GW-19D	0.2	0.4	1.6	1.8	2.0	-
GW-20	0.5	1.2	1.3	1.2	1.2	-
GW-21	2.8	2.0	1.0	0.9	1.0	-
GW-22S	16.5	163	[redacted]	[redacted]	[redacted]	-
GW-22D	[redacted]	[redacted]	75.5	[redacted]	85.8	-
GW-23	-	-	-	-	2.6	-
GW-24	-	-	-	-	3.2	-
GW-25	-	-	-	-	1.2	-
GW-26	-	-	-	-	58.6	40.6

TABLE C-8

PHYSIOCHEMICAL CHARACTERISTICS OF GROUND WATER AT WILMINGTON

Well Number	Chromium + 6, mg/l					
	3-81*	4-81	5-81	6-81	8-81	12-81
GW-1	0.05	0.01	BDL	0.02	BDL	-
GW-2 & 2A	0.10	0.01	BDL	-	BDL	BDL
GW-3	0.29	BDL	BDL	-	-	-
GW-4	0.05	BDL	BDL	0.01	BDL	BDL
GW-5	0.10	BDL	BDL	BDL	-	BDL
GW-6	0.82	BDL	BDL	BDL	BDL	-
GW-7	[redacted]	0.01	0.01	0.01	BDL	-
GW-8	0.08	BDL	BDL	BDL	-	-
GW-10	0.02	BDL	BDL	BDL	-	-
GW-11	0.70	BDL	0.01	0.01	BDL	BDL
GW-12	0.06	0.01	BDL	0.01	BDL	-
GW-13	0.15	BDL	BDL	BDL	-	-
GW-14	0.05	0.01	BDL	BDL	0.01	-
GW-15	0.20	0.03	BDL	BDL	-	-
GW-16	0.15	BDL	BDL	BDL	-	-
GW-17S	-	BDL	BDL	0.01	0.01	-
GW-17D	3.22	BDL	0.02	0.04	BDL	-
GW-18S	-	-	-	-	-	-
GW-18D	-	0.36	BDL	0.01	BDL	-
GW-19S	[redacted]	BDL	0.04	0.05	0.01	-
GW-19D	[redacted]	0.01	0.04	0.06	BDL	-
GW-20	0.02	0.39	BDL	BDL	BDL	-
GW-21	0.15	0.01	0.01	BDL	BDL	-
GW-22S	[redacted]	0.01	BDL	BDL	BDL	-
GW-22D	0.22	0.01	0.02	0.01	BDL	-
GW-23	-	-	-	-	BDL	-
GW-24	-	-	-	-	-	-
GW-25	-	-	-	-	-	-
GW-26	-	-	-	-	-	BDL

*Total metal - sample acidified.
Detection Limit: 0.01 mg/l

TABLE C-9

PHYSIOCHEMICAL CHARACTERISTICS OF GROUND WATER AT WILMINGTON

Well Number	Chromium + 3, mg/l					
	3-81*	4-81	5-81	6-81	8-81	12-81
GW-1	-	<0.05	<0.04	≤0.03	≤0.04	-
GW-2 & 2A	-	<0.05	<0.04	-	≤0.04	<0.05
GW-3	-	<0.05	<0.04	<0.04	-	-
GW-4	-	<0.05	<0.04	≤0.04	<0.04	<0.05
GW-5	-	<0.05	<0.04	<0.04	<0.04	<0.05
GW-6	-	<0.05	≤0.43	≤0.38	≤0.1	-
GW-7	-	<0.05	[redacted]	[redacted]	≤11.13	-
GW-8	-	<0.05	<0.04	<0.04	-	-
GW-10	-	<0.05	<0.04	<0.04	-	-
GW-11	-	<0.05	0.02	≤0.04	≤0.29	<0.04
GW-12	-	<0.05	<0.04	≤0.04	<0.04	-
GW-13	-	<0.05	<0.04	<0.04	-	-
GW-14	-	<0.05	<0.04	<0.04	≤0.04	-
GW-15	-	<0.05	<0.04	<0.04	-	-
GW-16	-	<0.05	<0.04	<0.04	-	-
GW-17S	-	<0.05	<0.04	≤0.04	≤0.04	-
GW-17D	-	<0.05	<0.04	0.08	≤0.71	-
GW-18S	-	-	-	-	-	-
GW-18D	-	≤0.01	<0.04	≤0.04	<0.04	-
GW-19S	-	<0.05	<0.04	<0.04	<0.04	-
GW-19D	-	<0.05	<0.04	0	≤0.08	-
GW-20	-	<0.01	<0.04	<0.04	<0.04	-
GW-21	-	<0.05	<0.04	≤0.11	<0.04	-
GW-22S	-	<0.05	<0.04	<0.04	<0.04	-
GW-22D	-	[redacted]	[redacted]	[redacted]	[redacted]	-
GW-23	-	-	-	-	<0.04	-
GW-24	-	-	-	-	-	-
GW-25	-	-	-	-	-	-
GW-26	-	-	-	-	-	<0.05

TABLE C-10

PHYSIOCHEMICAL CHARACTERISTICS OF GROUND WATER AT WILMINGTON

Well Number	Cadmium, mg/l					
	3-81*	4-81	5-81	6-81	8-81	12-81
GW-1	<0.01	BDL	BDL	BDL	BDL	-
GW-2 & 2A	<0.01	BDL	BDL	-	BDL	BDL
GW-3	<0.01	BDL	BDL	BDL	-	-
GW-4	0.01	0.01	0.02	BDL	BDL	BDL
GW-5	<0.01	BDL	BDL	BDL	-	BDL
GW-6	<0.01	[redacted]	0.[redacted]	[redacted]	[redacted]	-
GW-7	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
GW-8	<0.01	BDL	BDL	BDL	-	-
GW-10	<0.01	BDL	BDL	BDL	-	-
GW-11	<0.01	BDL	BDL	BDL	BDL	BDL
GW-12	<0.01	BDL	BDL	BDL	BDL	-
GW-13	<0.01	BDL	BDL	BDL	-	-
GW-14	<0.01	BDL	BDL	BDL	BDL	-
GW-15	<0.01	BDL	BDL	BDL	-	-
GW-16	<0.01	BDL	BDL	BDL	-	-
GW-17S	-	0.02	0.02	BDL	BDL	-
GW-17D	<0.01	[redacted]	[redacted]	[redacted]	[redacted]	-
GW-18S	-	-	-	-	-	-
GW-18D	-	BDL	0.02	BDL	0.02	-
GW-19S	<0.01	BDL	0.03	BDL	0.02	-
GW-19D	<0.01	BDL	BDL	BDL	0.02	-
GW-20	<0.01	BDL	BDL	BDL	0.02	-
GW-21	<0.01	BDL	BDL	BDL	0.02	-
GW-22S	<0.01	BDL	0.02	BDL	0.02	-
GW-22D	<0.01	[redacted]	[redacted]	[redacted]	[redacted]	-
GW-23	-	-	-	-	BDL	-
GW-24	-	-	-	-	-	-
GW-25	-	-	-	-	-	-
GW-26	-	-	-	-	-	BDL

*Total metal - sample acidified.

Detection Limit: 0.01 mg/l

TABLE C-11

PHYSIOCHEMICAL CHARACTERISTICS OF GROUND WATER AT WILMINGTON

Well Number	Lead, mg/l 3-81*	4-81	5-81	6-81	8-81	12-81
GW-1	<0.10	<0.10	<0.04	<0.05	<0.05	-
GW-2 & 2A	<0.20	<0.10	<0.04	-	<0.05	<0.05
GW-3	<0.10	<0.10	<0.04	<0.04	-	-
GW-4	<0.10	<0.10	<0.04	<0.04	<0.05	<0.05
GW-5	<0.10	<0.10	<0.04	<0.04	[redacted]	<0.05
GW-6	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
GW-7	[redacted]	[redacted]	[redacted]	[redacted]	<0.05	-
GW-8	[redacted]	<0.10	<0.04	<0.04	-	-
GW-10	<0.10	<0.10	<0.04	<0.04	-	-
GW-11	<0.10	[redacted]	<0.04	<0.04	<0.05	<0.05
GW-12	<0.10	<0.10	<0.04	<0.04	<0.05	-
GW-13	[redacted]	<0.10	<0.04	<0.04	-	-
GW-14	<0.10	<0.10	<0.04	<0.04	<0.050	-
GW-15	<0.10	<0.10	<0.04	<0.04	-	-
GW-16	<0.10	<0.10	<0.04	<0.04	-	-
GW-17S	-	[redacted]	[redacted]	<0.04	<0.05	-
GW-17D	[redacted]	[redacted]	[redacted]	<0.09	[redacted]	-
GW-18S	-	-	-	-	-	-
GW-18D	-	<0.10	<0.04	<0.04	<0.05	-
GW-19S	[redacted]	[redacted]	<0.04	<0.04	<0.05	-
GW-19D	[redacted]	<0.10	<0.04	<0.04	<0.05	-
GW-20	<0.10	<0.10	<0.04	<0.04	<0.05	-
GW-21	[redacted]	<0.10	<0.04	<0.04	<0.05	-
GW-22S	[redacted]	<0.10	[redacted]	<0.04	<0.05	-
GW-22D	<0.10	<0.10	[redacted]	[redacted]	[redacted]	-
GW-23	-	-	-	-	<0.05	-
GW-24	-	-	-	-	-	-
GW-25	-	-	-	-	-	
GW-26	-	-	-	-	-	<0.05

*Total metal - sample acidified.

TABLE C-12

PHYSIOCHEMICAL CHARACTERISTICS OF GROUND WATER AT WILMINGTON

Well Number	Dissolved Oxygen, mg/l 3-81	4-81	5-81	6-81	8-81	12-81
GW-1	-	1.8	2.0	3.2	-	-
GW-2 & 2A	-	1.8	2.2	-	-	-
GW-3	-	4.0	3.2	1.9	-	-
GW-4	-	3.2	3.0	1.4	-	-
GW-5	-	5.2	2.6	2.5	-	-
GW-6	-	2.6	2.8	2.0	-	-
GW-7	-	4.6	3.0	2.4	-	-
GW-8	-	1.5	2.8	5.0	-	-
GW-10	-	4.9	3.6	2.7	-	-
GW-11	-	1.9	2.0	1.7	-	-
GW-12	-	1.6	3.1	1.4	-	-
GW-13	-	1.4	2.8	4.5	-	-
GW-14	-	6.4	6.8	2.8	-	-
GW-15	-	2.1	1.5	1.8	-	-
GW-16	-	1.4	6.8	3.5	-	-
GW-17S	-	3.2	5.4	4.8	-	-
GW-17D	-	5.2	2.3	1.8	-	-
GW-18S	-	-	-	-	-	-
GW-18D	-	5.7	5.4	3.2	-	-
GW-19S	-	3.2	3.0	1.8	-	-
GW-19D	-	4.2	5.8	1.6	-	-
GW-20	-	4.4	3.3	4.7	-	-
GW-21	-	1.7	4.0	1.8	-	-
GW-22S	-	1.7	2.0	1.7	-	-
GW-22D	-	3.4	7.8	2.4	-	-
GW-23	-	-	-	-	-	-
GW-24	-	-	-	-	-	-
GW-25	-	-	-	-	-	-
GW-26	-	-	-	-	-	-

TABLE C-13

PHYSIOCHEMICAL CHARACTERISTICS OF GROUND WATER AT WILMINGTON

Well Number	Temperature, °C 3-81	4-81	5-81	6-81	8-81	12-81
GW-1	9	11	12	11.5	17.5	-
GW-2 & 2A	7	10.5	15	-	18	13
GW-3	7	8.5	13	13	20	-
GW-4	7	8	10.5	11.5	18	11
GW-5	5	8	13	14.5	19	10
GW-6	8	9	12	10	-	-
GW-7	6.5	8	13	12.5	18	-
GW-8	6	7.5	11	12.5	-	-
GW-10	6.5	8.5	12	13	18	-
GW-11	8	7	12	14	19	11.5
GW-12	6	7.5	11	13	17.5	-
GW-13	9	9.5	12.5	13.5	21	-
GW-14	9	7.5	15.5	16	19	-
GW-15	12	14.5	17	17	17	-
GW-16	7	10.5	14.5	15	21	-
GW-17S	-	8.5	11	12	16	-
GW-17D	7	8	10.5	11	11	-
GW-18S	-	-	-	-	-	-
GW-18D	-	7	15	11.5	16	-
GW-19S	7	8	12	13	19	-
GW-19D	8	10	12	11.5	14.5	-
GW-20	6.5	7	9.5	13	17	-
GW-21	7.5	8.5	12	13	18	-
GW-22S	5	9	12	12.5	22	-
GW-22D	8	9	12.5	11.5	15.5	-
GW-23	-	-	-	-	19	-
GW-24	-	-	-	-	-	-
GW-25	-	-	-	-	21	-
GW-26	-	-	-	-	-	12

APPENDIX D

INORGANIC CHEMICAL ANALYSES-SURFACE WATER

TABLE D-1

SURFACE WATER CHEMICAL ANALYSES

Well Number	pH 3-81	4-81	5-81	6-81	8-81	12-81
SS-1	6.2	6.8	6.0	6.7	5.9	7.1
SS-1A	-	-	-	-	6.2	-
SS-2	-	-	-	-	8.6	-
SS-5	6.5	6.7	7.1	6.5	7.1	7.4
SS-11	6.1	5.1	5.6	6.9	6.5	-
SS-12	6.1	6.1	5.6	6.6	6.7	6.0
SS-16	6.1	5.8	6.5	6.4	6.6	6.8
SS-N-A	-	-	-	-	-	-
SS-N-B	-	-	-	-	-	-
SS-N-C	-	-	-	-	-	-
SS-N-D	-	-	-	-	5.7	-
SS-N-E	-	-	-	-	-	-
SS-N-F	-	-	-	-	-	-
SS-N-G	-	-	-	-	-	-
LAG-1(SOLID)	-	-	-	-	-	-
LAG-1(LIQUID)	-	-	-	-	9.6	-
LAG-2(LIQUID)	-	-	-	-	8.7	-
UREA TANK SEWER	-	-	-	-	8.5	-
TOWN SEWER	-	-	-	-	-	-
SUMP-1	-	-	-	-	4.5	-

TABLE D-2

SURFACE WATER CHEMICAL ANALYSES

Well Number	Specific Conductance, umhos 3-81	4-81	5-81	6-81	8-81	12-81
SS-1	425	400	825	325	290	575
SS-1A	-	-	-	-	575	-
SS-2	-	-	-	-	4,500	
SS-5	6,000	5,000	8,000	7,000	950	950
SS-11	550	375	475	1,050	950	-
SS-12	7,500	6,700	5,500	5,000	5,926	4,250
SS-16	1,450	1,000	1,000	1,150	1,000	775
SS-N-A	-	-	-	-	-	-
SS-N-B	-	-	-	-	-	-
SS-N-C	-	-	-	-	-	-
SS-N-D	-	-	-	4,250	-	-
SS-N-E	-	-	-	-	-	-
SS-N-F	-	-	-	-	-	-
SS-N-G	-	-	-	-	-	-
LAG-1(SOLID)	-	-	-	-	-	-
LAG-1(LIQUID)	-	-	-	16,000	-	-
LAG-2(LIQUID)	-	-	-	58,000	-	-
UREA TANK SEWER	-	-	-	725	-	-
TOWN SEWER	-	-	-	-	-	-
SUMP-1	-	-	-	5,500	-	-

TABLE D-3

SURFACE WATER CHEMICAL ANALYSES

Well Number	Chlorides, mg/l 3-81	4-81	5-81	6-81	8-81	12-81
SS-1	51	43	36	41	50	48
SS-2	-	-	140	225	225	-
SS-5	440	475	592	500	100	81
SS-11	73	43	56	51	100	-
SS-12	892	619	562	459	360	182
SS-16	154	128	117	92	100	35
SS-N-A	-	-	-	414	50	-
SS-N-B	-	-	-	85	85	-
SS-N-C	-	-	-	64	70	-
SS-N-D	-	-	-	692	380	-
SS-N-E	-	-	-	64	80	-
SS-N-F	-	-	-	213	160	-
SS-N-G	-	-	-	<5	-	-
LAG-1(SOLID)	-	-	-	4902*	-	-
LAG-1(LIQUID)	-	-	-	4898	-	-
LAG-2(LIQUID)	-	-	-	5048	-	-

* mg/kg

TABLE D-4

SURFACE WATER CHEMICAL ANALYSES

Well Number	Sulfates, mg/l 3-81	4-81	5-81	6-81	8-81	12-81
SS-1	8	10	12	32	24	22
SS-2	-	-	222	3050	14	-
SS-5	1494	1337	1450	4220	138	131
SS-11	30	40	28	83	66	-
SS-12	2445	1913	1817	2620	1220	420
SS-16	179	191	120	222	120	100
SS-N-A	-	-	-	3125	155	-
SS-N-B	-	-	-	133	78	-
SS-N-C	-	-	-	60	51	-
SS-N-D	-	-	-	4167	1750	-
SS-N-E	-	-	-	89	73	-
SS-N-F	-	-	-	925	135	-
SS-N-G	-	-	-	24	-	-
LAG-1(SOLID)	-	-	-		333,333*	-
LAG-1(LIQUID)	-	-	-		15,800	-
LAG-2(LIQUID)	-	-	-		19,750	-

*mg/kg

TABLE D-5

SURFACE WATER CHEMICAL ANALYSES

Well Number	NH_3 - N, mg/l 3-81	4-81	5-81	6-81	8-81	12-81
SS-1	2	4	2	1	<1	2
SS-1A	-	-	-	-	1	-
SS-2	-	-	33	290	239	-
SS-5	255	376	476	535	28	31
SS-11	13	7	4	17	3	-
SS-12	374	390	468	347	203	111
SS-16	52	43	45	22	18	16
SS-N-A	-	408	551	377	28	-
SS-N-B	-	39	25	16	15	-
SS-N-C	-	20	3	2	6	-
SS-N-D	-	1022	1306	1127	287	-
SS-N-E	-	38	22	11	16	-
SS-N-F	-	471	448	185	52	-
SS-N-G	-	-	-	14	-	-
LAG-1(SOLID)	-	-	-	-	17*	-
LAG-1(LIQUID)	-	-	-	-	1232	-
LAG-2(LIQUID)	-	-	-	-	6671	-
UREA TANK	-	-	-	-	28	-
SEWER	-	-	-	-	15	-
SUMP-1	-	-	-	-	33	-

*mg/kg

TABLE D-6

SURFACE WATER CHEMICAL ANALYSES

Well Number	$(NO_3 + NO_2)$-N, mg/l 3-81	4-81	5-81	6-81	8-81	12-81
SS-1	2.1	1.9	0.9	1.9	1.5	1.0
SS-1A	-	-	-	-	0.9	-
SS-2	-	-	4.1	26.9	12.2	-
SS-5	7.2	3.5	2.7	4.7	3.5	2.7
SS-11	2.1	0.5	0.6	3.4	2.0	-
SS-12	5.4	5.0	3.9	6.8	4.9	3.3
SS-16	6.0	4.3	2.0	4.1	3.0	4.5
SS-N-A	-	4.3	5.1	5.8	1.4	-
SS-N-B	-	4.6	4.2	4.1	3.0	-
SS-N-C	-	0.7	1.9	1.9	1.4	-
SS-N-D	-	7.1	6.1	3.7	3.8	-
SS-N-E	-	3.6	2.9	3.6	3.2	-
SS-N-F	-	3.8	4.4	4.1	3.4	-
SS-N-G	-	-	-	2.3	-	-
LAG-1(SOLID)	-	-	-	-	137*	-
LAG-1(LIQUID)	-	-	-	-	81	-
LAG-2(LIQUID)	-	-	-	-	10.6	-
UREA TANK	-	-	-	-	1.4	-
SEWER	-	-	-	-	8.1	-
SUMP-1	-	-	-	-	26.3	-

*mg/kg

TABLE D-7

SURFACE WATER CHEMICAL ANALYSES

Well Number	Alkalinity, mg/l					
	3-81	4-81	5-81	6-81	8-81	12-81
SS-1	366	44	41	45	-	42
SS-1A	-	-	-	-	35	-
SS-2	-	-	390	870	-	-
SS-5	78	192	210	65	-	26
SS-11	30	800	30	28	-	-
SS-12	73	170	161	112	-	33
SS-16	58	62	60	55	-	52
SS-N-A	-	-	-	58	-	-
SS-N-B	-	-	-	60	-	-
SS-N-C	-	-	-	25	-	-
SS-N-D	-	-	-	220	-	-
SS-N-E	-	-	-	55	-	-
SS-N-F	-	-	-	80	-	-
SS-N-G	-	-	-	<1	-	-
LAG-1(SOLID)	-	-	-	-	-	-
LAG-1(LIQUID)	-	-	-	-	4150	-
LAG-2(LIQUID)	-	-	-	-	1210	-
UREA TANK	-	-	-	-	65	-
SEWER	-	-	-	-	85	-
SUMP-1	-	-	-	-	32	-

TABLE D-8

SURFACE WATER CHEMICAL ANALYSES

Well Number	Chromium + 6, mg/l					
	3-81*	4-81	5-81	6-81	8-81	12-81
SS-1	<0.02	<0.01	BDL	BDL	-	BDL
SS-1A	-	-	-	-	BDL	-
SS-2	-	-	0.01	0.03	BDL	-
SS-5	0.18	0.03	0.01	BDL	BDL	BDL
SS-11	0.16	0.01	0.01	BDL	BDL	-
SS-12	0.42	BDL	BDL	BDL	-	BDL
SS-16	<0.02	BDL	BDL	BDL	-	BDL

Detection Limit: 0.01 mg/l

*Total metal - sample acidified

TABLE D-9

SURFACE WATER CHEMICAL ANALYSES

Well Number	Chromium + 3, mg/l					
	3-81	4-81	5-81	6-81	8-81	12-81
SS-1	-	<0.05	<0.04	<0.04	<0.04	<0.04
SS-1A	-	-	-	-	-	-
SS-2	-	-	<0.04	≤0.02	<0.04	-
SS-5	-	<0.05	<0.04	<0.04	<0.04	<0.04
SS-11	-	<0.05	<0.04	<0.04	<0.04	-
SS-12	-	<0.05	<0.04	<0.04	<0.04	<0.04
SS-16	-	<0.05	<0.04	<0.04	<0.04	<0.04

TABLE D-10

SURFACE WATER CHEMICAL ANALYSES

Well Number	Cadmium, mg/l					
	3-81*	4-81	5-81	6-81	8-81	12-81
SS-1	BDL	BDL	BDL	BDL	BDL	BDL
SS-1A	-	-	-	-	-	-
SS-2	-	-	<0.01	BDL	-	-
SS-5	BDL	BDL	BDL	BDL	BDL	BDL
SS-11	BDL	BDL	BDL	BDL	BDL	-
SS-12	BDL	BDL	BDL	BDL	-	BDL
SS-16	BDL	BDL	BDL	BDL	-	BDL

Detection Limit: 0.01 mg/l

Total metal - sample acidified

TABLE D-11

SURFACE WATER CHEMICAL ANALYSES

Well Number	Lead, mg/l					
	3-81*	4-81	5-81	6-81	8-81	12-81
SS-1	<0.10	<0.10	BDL	BDL	-	BDL
SS-1A	-	-	-	-	BDL	-
SS-2	-	-	BDL	BDL	BDL	-
SS-5	<0.10	<0.10	BDL	BDL	BDL	BDL
SS-11	<0.10	<0.10	BDL	BDL	BDL	-
SS-12	<0.10	<0.10	BDL	BDL	-	BDL
SS-16	<0.10	<0.10	BDL	BDL	-	BDL

Detection Limit: 0.04 mg/l

*Total metal - sample acidified

TABLE D-12

SURFACE WATER CHEMICAL ANALYSES

Well Number	Dissolved Oxygen, mg/l 3-81	4-81	5-81	6-81	8-81	12-81
SS-1	-	6.7	8.2	6.4	-	-
SS-1A	-	-	-	-	-	-
SS-2	-	-	-	-	-	-
SS-5	-	10.4	8.5	3.5	-	-
SS-11	-	11.0	2.6	6.2	-	-
SS-12	-	10.4	6.2	6.9	-	-
SS-16	-	9.0	6.0	6.5	-	-
SS-N-A	-	-	-	-	-	-
SS-N-B	-	-	-	-	-	-
SS-N-C	-	-	-	-	-	-
SS-N-D	-	-	-	-	-	-
SS-N-E	-	-	-	-	-	-
SS-N-F	-	-	-	-	-	-
SS-N-G	-	-	-	-	-	-
LAG-1(SOLID)	-	-	-	-	-	-
LAG-1(LIQUID)	-	-	-	-	-	-
LAG-2(LIQUID)	-	-	-	-	-	-
UREA TANK	-	-	-	-	-	-
SEWER	-	-	-	-	-	-
SUMP-1	-	-	-	-	-	-

TABLE D-13

SURFACE WATER CHEMICAL ANALYSES

Well Number	Temperature, °C					
	3-81	4-81	5-81	6-81	8-81	12-81
SS-1	6	7	22	23	24	7
SS-1A	-	-	-	-	23	-
SS-2	-	-	-	-	18	-
SS-5	6	12.5	23	25	28	4
SS-11	10.5	11.5	19	24	26	-
SS-12	8.5	7.5	18	23	25	2.5
SS-16	8	12.5	23	29.5	29	5
SS-N-A	-	-	-	-	-	-
SS-N-B	-	-	-	-	-	-
SS-N-C	-	-	-	-	-	-
SS-N-D	-	-	-	-	-	-
SS-N-E	-	-	-	-	-	-
SS-N-F	-	-	-	-	-	-
SS-N-G	-	-	-	-	-	-
LAG-1(SOLID)	-	-	-	-	-	-
LAG-1(LIQUID)	-	-	-	-	-	-
LAG-2(LIQUID)	-	-	-	26	-	-
UREA TANK	-	-	-	-	-	-
SEWER	-	-	-	-	-	-
SUMP-1	-	-	-	20	-	-

APPENDIX E

ORGANIC CHEMICAL ANALYSES

TABLE E-2

COMPARISON OF EPA, OLIN AND PIRNIE SAMPLING RESULTS, mg/l

Surface Water

PARAMETER	SAMPLE NUMBER SS-5							
	EPA	Olin	PIRNIE					
	11-80	11-80	3-81	4-81	5-81	6-81	8-81	12-81
Organic								
N-nitrosodiphenylamine	0.04	BDL	BDL	-	BDL	-	BDL	BDL
DOP	0.1	>0.2*	0.02	-	0.02	-	0.1	BDL
Carbon tetrachloride	BDL	BDL	BDL	-	BDL	-	BDL	BDL
Fluoranthene	BDL	0.001	BDL	-	BDL	-	BDL	BDL
Butyl benzyl phthalate	BDL	0.001	BDL	-	BDL	-	BDL	BDL
Di-n-butyl phtholate	BDL	0.001	BDL	-	BDL	-	BDL	BDL
Phenanthrene/Anthracene	BDL	0.001	BDL	-	BDL	-	BDL	BDL

*Due to detector saturation, actual concentrations may be significantly greater.

BDL - Below detection limit

TABLE E-3

NON-PRIORITY POLLUTANT BASE-NEUTRAL COMPOUNDS

SURFACE WATER

Sample Location	Compound	Concentration*
SS-2	1,1^{1} Oxybisbenzene	Low
	Octhanethioicic acid, S-Hexylester	Low
	2H-Azepin-2-One, Hexahydro-y-Me	Low
SS-5	No Base-Neutrals Detected	
SS-16	1,1^{1} Oxybisbenzene	Low
	9H-Carbazole	Low
	2H-1-Benzopyran	Low
	Conoyfolan-16-Carboxylic acid	Low

GROUND WATER

GW-5	No Base-Neutrals Detected	

* Low concentration = <0.05 mg/l
Med. concentration = 0.05 - 0.2 mg/l
High concentration = >0.2 mg/l

APPENDIX E

ORGANIC ANALYSIS TECHNIQUES

1.	Volatile Organics	Method 624, Federal Register 12-3-79
2.	Base/Neutral Extractable Organics	Method 625, Federal Register, 12-3-79

TABLE E-1

COMPARISON OF EPA, OLIN AND PIRNIE SAMPLING RESULTS, mg/l

Ground Water

PARAMETER	WELL NUMBER															
	GW-5								GW-10							
	EPA	OLIN	PIRNIE						EPA	OLIN	PIRNIE					
	11-80	11-80	3-81	4-81	5-81	6-81	8-81	12-81	11-80	11-80	3-81	4-81	5-81	6-81	8-81	12-81
Organic																
N-nitrosodiphenyl-amine	BDL	BDL	BDL	-	BDL	-	-	BDL	0.01	BDL	BDL	-	-	-	-	-
DOP	BDL	0.17	0.02	-	0.03	-	-	0.02	0.02	>0.22*	BDL	-	-	-	-	-
Carbon tetra-chloride	BDL	BDL	BDL	-	BDL	-	-	BDL	0.01	BDL	BDL	-	-	-	-	-
Fluoranthene	BDL	BDL	BDL	-	BDL	-	-	BDL	BDL	0.0002	BDL	-	-	-	-	-
Di-n-butyl phthalate	BDL	0.001	BDL	-	BDL	-	-	BDL	BDL	0.001	BDL	-	-	-	-	-
Phenanthrene/ Anthracene	BDL	0.002	BDL	-	BDL	-	-	BDL	BDL	0.005	BDL	-	-	-	-	-

*Due to detector saturation, actual concentrations may be significantly greater.
BDL - Below detection limit

TABLE E-4

NON-PRIORITY POLLUTANT VOLATILE COMPOUNDS

SURFACE WATER

Sample Location	Compound	Concentration*
SS-5	Acetone	High
SS-16	Acetone	Med
	2-Butanone	Med
	2-Butanol	Low
	4-Methylpentanone	Med
	2,4,4-Trimethyl-2-Pentene	Low
	4,4-Dimethyl-2-Pentanone	Low
	2,4,4 Trimethyl-1-Pentene	Med
	3,3-Dimethylbutanoic acid	Low
	1,3-Dimethylbenzene	Low
	1,3-Dimethylbenzene	

GROUND WATER

Sample Location	Compound	Concentration*
GW-5	Acetone	Med

* Low concentrations = <0.05 mg/l
Med. concentrations = 0.05 - 0.2 mg/l
High concentrations = >0.2 mg/l

FIGURE E 5

PRIORITY POLLUTANT VOLATILES IN SURFACE WATER, MG/L

	BENZENE				BROMOFORM				CARBON TETRACHLORIDE				CHLORODIBROMOMETHANE			
	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81
SS-1	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
SS-1A	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-
SS-2	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-
SS-5	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
SS-11	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
SS-12	BDL	BDL	-	BDL	[illegible]	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
SS-16	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
LAG L	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-

	CHLOROETHANE				CHLOROFORM				DICHLOROBROMOMETHANE				1-1-DICHLOROETHANE				1,2-DICHLOROETHANE			
	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81
SS-1	[illegible]	[illegible]	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	[illegible]	[illegible]	-	BDL	BDL	BDL	-	BDL
SS-1A	-	-	[illegible]	-	-	-	BDL	-	-	-	BDL	-	-	-	[illegible]	-	-	-	BDL	-
SS-2	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-
SS-5	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
SS-11	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
SS-12	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
SS-16	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
LAG L	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-	[illegible]	-

	ETHYLBENZENE				METHYL CHLORIDE				METHYLENE CHLORIDE				1,1,2,2-TETRACHLOROETHANE			
	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81
SS-1	BDL	BDL	-	BDL	BDL	BDL	-	BDL	[illegible]	BDL	-	BDL	BDL	BDL	-	BDL
SS-1A	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-
SS-2	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-
SS-5	BDL	BDL	-	BDL	BDL	BDL	-	BDL	[illegible]	BDL	-	[illegible]	BDL	BDL	-	BDL
SS-11	BDL	BDL	-	-	BDL	BDL	-	-	[illegible]	BDL	-		BDL	BDL	-	-
SS-12	BDL	BDL	-	BDL	BDL	BDL	-	BDL	[illegible]	BDL	-	[illegible]	BDL	BDL	-	BDL
SS-16	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	[illegible]	BDL	BDL	BDL	BDL	BDL	BDL	BDL
LAGOON LIQUID	-	-	BDL	-	-	-	BDL	-	-	-	[illegible]	-	-	-	BDL	-

	TOLUENE				1,1,1-TRICHLOROETHANE				TRICHLOROETHYLENE			
	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81
SS-1	0.78	0.350	-	0.310	[illegible]	[illegible]	-	BDL	BDL	BDL	-	BDL
SS-1A	-	-	[illegible]	-	-	-	[illegible]	-	-	-	BDL	-
SS-2	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-
SS-5	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
SS-11	BDL	BDL	-		BDL	BDL	-	-	BDL	BDL	-	BDL
SS-12	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
SS-16	[illegible]	[illegible]	BDL	[illegible]	[illegible]	[illegible]	[illegible]	BDL	BDL	BDL	BDL	[illegible]
LAGOON LIQUID	-	-	0.003	-	-	-	BDL	-				

PRIORITY POLLUTANT BASE/NEUTRALS IN SURFACE WATER, MG/L

	ACENAPHTYLENE				ANTHRACENE[□]				BIS (2-ETHYLHEXYL) PHTHALATE (BOP)				4-BROMOPHENYL PHENYL ETHER			
	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81
SS-1	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-	BDL
SS-1A	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-
SS-2	-	-	BDL	-	-	-	BDL	-	-	-	[illegible]	-	-	-	BDL	-
SS-5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	[illegible]	[illegible]	0.100	BDL	BDL	BDL	BDL	BDL
SS-11	BDL	-	-	-	BDL	-	-	-	[illegible]	-	-	-	BDL	-	-	-
SS-12	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
SS-16	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	[illegible]	[illegible]	[illegible]	[illegible]	BDL	BDL	BDL	BDL
LAGOON LIQUID	-	-	BDL	-	-	-	BDL	-	-	-	[illegible]	-	-	-	BDL	-

	BUTYL BENZYL PHTHALATE				DI-N-BUTYL PHTHALATE				FLUORENE			
	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81
SS-1	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-	BDL
SS-1A	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-
SS-2	-	BDL	-	-	-	BDL	-	-	-	-	BDL	-
SS-5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
SS-11	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
SS-12	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
SS-16	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
LAGOON LIQUID	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-

	NAPHTHALENE				"N-NITROSODIPHENYLAMINE" **			
	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81
SS-1	BDL	-	-	BDL	BDL	-	-	BDL
SS-1A	-	-	-	BDL	-	-	-	BDL
SS-2	-	-	BDL	-	-	-	BDL	-
SS-5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
SS-11	BDL	-	-	-	BDL	-	-	-
SS-12	BDL	BDL	-	BDL	BDL	BDL	-	BDL
SS-16	BDL	BDL	BDL	BDL	[illegible]	[illegible]	BDL	[illegible]
LAGOON LIQUID	-	-	BDL	-	-	-	0.037	-

	PHENANTHRENE[□]				DIOCTYL-DIPHENYLAMINE			
	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81
SS-1	BDL	-	-	BDL	BDL	-	-	BDL
SS-1A	-	-	BDL	-	-	-	BDL	-
SS-2	-	-	BDL	-	-	-	BDL	-
SS-5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
SS-11	BDL	-	-	-	BDL	-	-	-
SS-12	BDL	BDL	-	BDL	BDL	BDL	-	BDL
SS-16	BDL	BDL	BDL		BDL	[illegible]	-	
LAGOON LIQUID	-	-	BDL	-	-	-	-	-

NOTES:

- * Quantitated from secondary ion.
- □ Indistinguishable isomers.
- ▲ Concentration estimated, quantitation ion saturated.
- BDL Below Detectable Limit
- \- Not sampled
- ** Detected as Diphenylamine (Approximately 20% N-Nitrosodiphenylamine)

OLIN CHEMICALS GROUP
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PRIORITY POLLUTANT BASE/NEUTRALS IN SURFACE WATER, MG/L

FIGURE E-6

Well	Acenaphthylene 3-81	5-81	8-81	12-81	Anthracene[□] 3-81	5-81	8-81	12-81	Bis (2-Ethylhexyl) Phthalate (DOP) 3-81	5-81	8-81	12-81
GW-1	BDL	BDL	-	-	BDL	BDL	-	-	[illegible]	[illegible]	-	-
GW-2 & 2A	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	[illegible]	[illegible]	[illegible]	[illegible]
GW-3	BDL	BDL	-	-	BDL	BDL	-	-	[illegible]	[illegible]	-	-
GW-4	BDL	-	-		BDL	BDL	-	-	[illegible]	-	-	[illegible]
GW-5	BDL	BDL	-		BDL	BDL	-	-	[illegible]	[illegible]	-	[illegible]
GW-6	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-7	BDL	BDL	BDL	-	BDL	BDL	BDL	-	[illegible]	[illegible]	[illegible]	-
GW-8	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-10	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-11	BDL	BDL	BDL	BDL	BDL	[illegible]	[illegible]	BDL	BDL	BDL	[illegible]	[illegible]
GW-12	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-13	BDL	BDL	BDL	-	BDL	BDL	BDL	-	[illegible]	[illegible]	[illegible]	-
GW-14	BDL	BDL	BDL	-	BDL	BDL	BDL	-	[illegible]	[illegible]	[illegible]	-
GW-15	BDL	BDL	-	-	BDL	BDL	-	-	[illegible]	[illegible]	-	-
GW-16	BDL	BDL	BDL	-	BDL	BDL	BDL	-	[illegible]	[illegible]	[illegible]	-
GW-17S	-	BDL	-	-	-	BDL	-	-	-	[illegible]	-	-
GW-17D	BDL	BDL	BDL	-	BDL	BDL	BDL	-	[illegible]	[illegible]	[illegible]	-
GW-18S	-	-	-	-	-	-	-	-	-	-	-	-
GW-18D	-	-	-	-	-	BDL	BDL	-	-	[illegible]	[illegible]	-
GW-19S	BDL	BDL	BDL	-	BDL	BDL	BDL	-	[illegible]	[illegible]	[illegible]	-
GW-19D	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-20	BDL	BDL	BDL	-	BDL	BDL	BDL	-	[illegible]	[illegible]	[illegible]	-
GW-21	[illegible]	BDL	BDL	-	[illegible]	BDL	BDL	-	[illegible]	[illegible]	[illegible]	-
GW-22S	BDL	BDL	BDL	-	BDL	BDL	BDL	-	[illegible]	[illegible]	[illegible]	-
GW-22D	BDL	BDL	BDL	-	BDL	BDL	BDL	-	[illegible]	0.170	0.074	-
GW-23	-	-	BDL	-	-	-	BDL	-	-	-	[illegible]	-
GW-24	-	-	-	-	-	-	-	-	-	-	-	-
GW-25	-	-	-	-	-	-	-	-	-	-	-	-
GW-26	-	-	-	-	-	-	-	-	-	-	-	-

Well	4-Bromophenyl Phenyl Ether 3-81	5-81	8-81	12-81	Butyl Benzyl Phthalate 3-81	5-81	8-81	12-81	Di-N-Butyl Phthalate 3-81	5-81	8-81	12-81
GW-1	[illegible]	[illegible]	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-2 & 2A	BDL	BDL	BDL	BDL	[illegible]	[illegible]	BDL		[illegible]	[illegible]	[illegible]	BDL
GW-3	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-4	BDL	-	-		BDL	-	-		BDL	-	-	
GW-5	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
GW-6	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-7	BDL	0.011	BDL	-	BDL	[illegible]	BDL	-	BDL	BDL	BDL	-
GW-8	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-10	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-11	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
GW-12	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-13	BDL	BDL	BDL	-	[illegible]	[illegible]	BDL	-	BDL	BDL	BDL	-
GW-14	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-
GW-15	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-16	BDL	BDL	BDL	-	BDL	BDL	BDL	-	[illegible]	BDL	[illegible]	-
GW-17S	-	BDL	-	-	-	BDL	-	-	-	BDL	-	-
GW-17D	BDL	BDL	BDL	-	[illegible]	BDL	BDL	-	BDL	BDL	BDL	-
GW-18S	-	-	-	-	-	-	-	-	-	-	-	-
GW-18D	-	-	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-
GW-19S	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-
GW-19D	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-20	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-
GW-21	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-
GW-22S	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-
GW-22D	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-
GW-23	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-
GW-24	-	-	-	-	-	-	-	-	-	-	-	-
GW-25	-	-	-	-	-	-	-	-	-	-	-	-
GW-26	-	-	-	-	-	-	-	-	-	-	-	-

Well	Fluorene 3-81	5-81	8-81	12-81	Naphthalene 3-81	5-81	8-81	12-81	N-Nitroso-diphenylamine* ** 3-81	5-81	8-81	12-81
GW-1	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-2 & 2A	BDL	BDL	BDL		BDL	BDL	BDL	BDL	[illegible]	[illegible]	BDL	11.0
GW-3	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-4	BDL	-	-		BDL	-	-		BDL	-	-	
GW-5	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
GW-6	BDL	BDL	-	-	BDL	-	-	-	BDL	-	-	-
GW-7	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-
GW-8	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-10	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-11	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	[illegible]	0.015	[illegible]	BDL
GW-12	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-13	BDL	BDL	BDL	-	BDL	BDL	BDL	-	[illegible]	[illegible]	[illegible]	-
GW-14	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	[illegible]	BDL	-
GW-15	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-16	BDL	BDL	BDL	-	BDL	BDL	BDL	-	0.340	BDL	[illegible]	-
GW-17S	-	BDL	-	-	-	BDL	-	-	-	BDL	-	-
GW-17D	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	[illegible]	-
GW-18S	-	-	-	-	-	-	-	-	-	-	-	-
GW-18D	-	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-
GW-19S	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-
GW-19D	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-20	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-
GW-21	[illegible]	BDL	BDL	-	[illegible]	BDL	BDL	-	BDL	BDL	BDL	-
GW-22S	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	0.040	BDL	-
GW-22D	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL	[illegible]	0.017	-
GW-23	-	-	BDL	-	-	-	BDL	-	-	-	[illegible]	-
GW-24	-	-	-	-	-	-	-	-	-	-	-	-
GW-25	-	-	-	-	-	-	-	-	-	-	-	-
GW-26	-	-	-	-	-	-	-	-	-	-	-	-

Well	Phenanthrene[□] 3-81	5-81	8-81	12-81	Dioctyl-diphenylamine 3-81	5-81	8-81	12-81
GW-1	BDL	BDL	-	-	BDL	BDL	-	-
GW-2 & 2A	BDL	BDL	BDL	BDL	[illegible]	[illegible]		-
GW-3	BDL	BDL	-	-	BDL	BDL	-	-
GW-4	BDL	-	-	-	BDL	-	-	-
GW-5	BDL	BDL	-	BDL	BDL	BDL	-	-
GW-6	BDL	-	-	-	BDL	-	-	-
GW-7	BDL	BDL	BDL	-	BDL	BDL	BDL	-
GW-8	BDL	-	-	-	BDL	-	-	-
GW-10	BDL	-	-	-	BDL	-	-	-
GW-11	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
GW-12	BDL	-	-	-	BDL	-	-	-
GW-13	BDL	BDL	BDL	-	[illegible]	0.440		-
GW-14	BDL	BDL	-	-	[illegible]	[illegible]		-
GW-15	BDL	BDL	-	-	[illegible]	[illegible]		-
GW-16	BDL	BDL	BDL	-	[illegible]	[illegible]		-
GW-17S	-	BDL	-	-	-	BDL	-	-
GW-17D	BDL	BDL	BDL	-	[illegible]	[illegible]		-
GW-18S	-	-	-	-	-	-	-	-
GW-18D	-	BDL	BDL	-	-	BDL	BDL	-
GW-19S	BDL	BDL	BDL	-	BDL	[illegible]		-
GW-19D	BDL	-	-	-	BDL	-	-	-
GW-20	BDL	BDL	BDL	-	BDL	BDL	BDL	-
GW-21	0.020	BDL	BDL	-	BDL	BDL	BDL	-
GW-22S	BDL	BDL	BDL	-	[illegible]	[illegible]	-	-
GW-22D	BDL	BDL	BDL	-	[illegible]	[illegible]		-
GW-23	-	-	BDL	-	-	-		-
GW-24	-	-	-	-	-	-	-	-
GW-25	-	-	-	-	-	-	-	-
GW-26	-	-	-	-	-	-	-	-

NOTES:

- * Quantitated from secondary ion.
- □ Indistinguishable isomers.
- ▲ Concentration estimated, quantitation ion saturated.
- BDL Below Detectable Limit
- \- Not sampled
- ** Detected as Diphenylamine (Approximately 20% N-Nitrosodiphenylamine)

OLIN CHEMICALS GROUP
WILMINGTON, MASS.

PRIORITY POLLUTANT BASE/NEUTRALS
IN GROUND WATER, MG/L

FIGURE E-4

	BENZENE				BROMOFORM				CARBON TETRACHLORIDE			
	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81
GW-1	BDL	-	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-2 & 2A	[redacted]	[redacted]	-	[redacted]	BDL	BDL	-	BDL	BDL	BDL	-	BDL
GW-3	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-4	BDL	-	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
GW-5	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
GW-6	BDL	BDL	-	-	[redacted]	[redacted]	-	-	BDL	BDL	-	-
GW-7	BDL	BDL	-	-	[redacted]	[redacted]	-	-	BDL	BDL	-	-
GW-8	BDL	-	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-10	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-11	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-12	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-13	BDL		-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-14	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-15	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-16	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-17S	-	-	-	-	-	-	-	-	-	-	-	-
GW-17D	BDL	-	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-18S	-	-	-	-	-	-	-	-	-	-	-	-
GW-18D	-	-	-	-	-	-	-	-	-	-	-	-
GW-19S	BDL		-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-19D	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-20	BDL	-	-	-	-	BDL	-	-	BDL	BDL	-	-
GW-21	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-22S	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-22D	BDL	BDL	-	-	BDL	BDL	-	-	BDL	[redacted]	-	-
GW-23	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-
GW-24	-	-	-	-	-	-	-	-	-	-	-	-
GW-25	-	-	-	-	-	-	-	-	-	-	-	-
GW-26	-	-	-	-	-	-	-	-	-	-	-	-

	CHLORODIBROMOMETHANE				CHLOROETHANE				CHLOROFORM			
	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81
GW-1	BDL	BDL	-	-	BDL	BDL	-	-	BDL	0.010	-	-
GW-2 & 2A	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
GW-3	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-4	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
GW-5	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
GW-6	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-7	[redacted]	[redacted]	-	-	BDL	BDL	-	-	BDL	[redacted]	-	-
GW-8	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-10	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-11	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-12	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-13	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-14	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-15	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-16	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-17S	-	-	-	-	-	-	-	-	-	-	-	-
GW-17D	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-18S	-	-	-	-	-	-	-	-	-	-	-	-
GW-18D	-	-	-	-	-	-	-	-	-	-	-	-
GW-19S	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-19D	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-20	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-21	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-22S	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-22D	BDL	BDL	-	-	BDL	BDL	-	-	BDL	[redacted]	-	-
GW-23	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-
GW-24	-	-	-	-	-	-	-	-	-	-	-	-
GW-25	-	-	-	-	-	-	-	-	-	-	-	-
GW-26	-	-	-	-	-	-	-	-	-	-	-	-

	DICHLOROBROMOMETHANE				1-1-DICHLOROETHANE				1,2-DICHLOROETHANE			
	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81
GW-1	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-2 & 2A	BDL	BDL	-	BDL	BDL	BDL	-	BDL	[redacted]	[redacted]	-	BDL
GW-3	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-4	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
GW-5	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
GW-6	BDL	BDL	-	-	BDL	BDL	-	-	[redacted]	[redacted]	-	-
GW-7	BDL	[redacted]	-	-	BDL	BDL	-	-	[redacted]	[redacted]	-	-
GW-8	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-10	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-11	BDL	BDL	-	-	BDL	BDL	-	-	[redacted]	[redacted]	-	-
GW-12	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-13	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-14	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-15	BDL	BDL	-	-	BDL	BDL	-	-	[redacted]	[redacted]	-	-
GW-16	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-17S	-	-	-	-	-	-	-	-	-	-	-	-
GW-17D	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-18S	-	-	-	-	-	-	-	-	-	-	-	-
GW-18D	-	-	-	-	-	-	-	-	-	-	-	-
GW-19S	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-19D	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-20	BDL	BDL	-	-	BDL	BDL	-	-	BDL	[redacted]	-	-
GW-21	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-22S	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-22D	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-23	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-
GW-24	-	-	-	-	-	-	-	-	-	-	-	-
GW-25	-	-	-	-	-	-	-	-	-	-	-	-
GW-26	-	-	-	-	-	-	-	-	-	-	-	-

	ETHYLBENZENE				METHYL CHLORIDE				METHYLENE CHLORIDE			
	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81
GW-1	BDL	BDL	-	-	BDL	BDL	-	-	[redacted]	BDL	-	-
GW-2 & 2A	BDL	[redacted]	-	BDL	[redacted]	BDL	-	BDL	[redacted]	BDL	-	BDL
GW-3	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-4	BDL	-	-	BDL	BDL		-	BDL	[redacted]	BDL	-	[redacted]
GW-5	BDL	BDL	-	BDL	BDL	BDL	-	BDL	[redacted]	BDL	-	[redacted]
GW-6	BDL	BDL	-	-	BDL	BDL	-	-	[redacted]	[redacted]	-	-
GW-7	BDL	BDL	-	-	BDL	0.010	-	-	[redacted]	BDL	-	-
GW-8	BDL	-	-	-	BDL	BDL	-	-	[redacted]	BDL	-	-
GW-10	BDL	-	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-11	BDL	BDL	-	BDL	[redacted]	[redacted]	-	BDL	[redacted]	[redacted]	-	BDL
GW-12	BDL	BDL	-	-	BDL	BDL	-	-	[redacted]	BDL	-	-
GW-13	BDL	-	-	-	BDL	BDL	-	-	[redacted]	BDL	-	-
GW-14	BDL	-	-	-	BDL	-	-	-	0.011	BDL	-	-
GW-15	BDL	BDL	-	-	BDL	BDL	-	-	0.020	BDL	-	-
GW-16	[redacted]	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-17S	-	-	-	-	-	-	-	-	-	-	-	-
GW-17D	BDL	-	-	-	BDL	BDL	-	-	0.006	BDL	-	-
GW-18S	-	-	-	-	-	-	-	-	-	-	-	-
GW-18D	-	-	-	-	-	-	-	-	-	-	-	-
GW-19S	BDL	-	-	-	BDL	BDL	-	-	0.007	BDL	-	-
GW-19D	BDL	BDL	-	-	BDL	BDL	-	-	[redacted]	BDL	-	-
GW-20	BDL	-	-	-	BDL	BDL	-	-	[redacted]	BDL	-	-
GW-21	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-22S	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-22D	BDL	BDL	-	-	BDL	BDL	-	-	[redacted]	BDL	-	-
GW-23	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-
GW-24	-	-	-	-	-	-	-	-	-	-	-	-
GW-25	-	-	-	-	-	-	-	-	-	-	-	-
GW-26	-	-	-	-	-	-	-	-	-	-	-	-

	1,1,2,2-TETRACHLORO-ETHANE				TOLUENE				1,1,1-TRICHLORO-ETHANE			
	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81	3-81	5-81	8-81	12-81
GW-1	BDL	BDL	-	-	BDL	-	-	-	BDL	[redacted]	-	-
GW-2 & 2A	BDL	BDL	-	BDL	[redacted]	[redacted]	-	[redacted]	BDL	BDL	-	BDL
GW-3	BDL	-	-	-		-	-	-	BDL	-	-	-
GW-4	BDL	BDL	-	BDL	BDL		-	BDL	BDL	[redacted]	-	BDL
GW-5	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
GW-6	BDL	BDL	-	-	0.034	0.010	-	-	BDL	BDL	-	-
GW-7	BDL	BDL	-	-	[redacted]	[redacted]	-	-	BDL	BDL	-	-
GW-8	BDL	BDL	-	-	BDL	-	-	-	BDL	BDL	-	-
GW-10	BDL		-	-	BDL	-	-	-	BDL	BDL	-	-
GW-11	BDL	BDL	-	BDL	BDL	BDL	-	BDL	BDL	BDL	-	BDL
GW-12	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-13	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-14	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-15	BDL	BDL	-	-	BDL	BDL	-	-	BDL	BDL	-	-
GW-16	[redacted]	BDL	-	-	[redacted]	BDL	-	-	BDL	BDL	-	-
GW-17S	-	-	-	-	-	-	-	-	-	-	-	-
GW-17D	BDL	BDL	-	-	BDL	-	-	-	BDL	BDL	-	-
GW-18S	-	-	-	-	-	-	-	-	-	-	-	-
GW-18D	-	-	-	-	-	-	-	-	-	-	-	-
GW-19S	BDL	BDL	-	-	BDL	-	-	-	BDL	BDL	-	-
GW-19D	BDL	BDL	-	-	[redacted]	[redacted]	-	-	BDL	BDL	-	-
GW-20	BDL	BDL	-	-	BDL	-	-	-	BDL	BDL	-	-
GW-21	BDL	-	-	-	BDL	-	-	-	BDL	-	-	-
GW-22S	BDL	BDL	-	-	[redacted]	[redacted]	-	-	BDL	BDL	-	-
GW-22D	BDL	BDL	-	-	[redacted]	[redacted]	-	-	BDL	BDL	-	-
GW-23	-	-	BDL	-	-	-	BDL	-	-	-	BDL	-
GW-24	-	-	-	-	-	-	-	-	-	-	-	-
GW-25	-	-	-	-	-	-	-	-	-	-	-	-
GW-26	-	-	-	-	-	-	-	-	-	-	-	-

NOTES:

- * Quantitated from secondary ion.
- ☐ Indistinguishable isomers.
- ▲ Concentration estimated, quantitation ion satur.
- BDL Below Detectable Limit
- \- Not sampled

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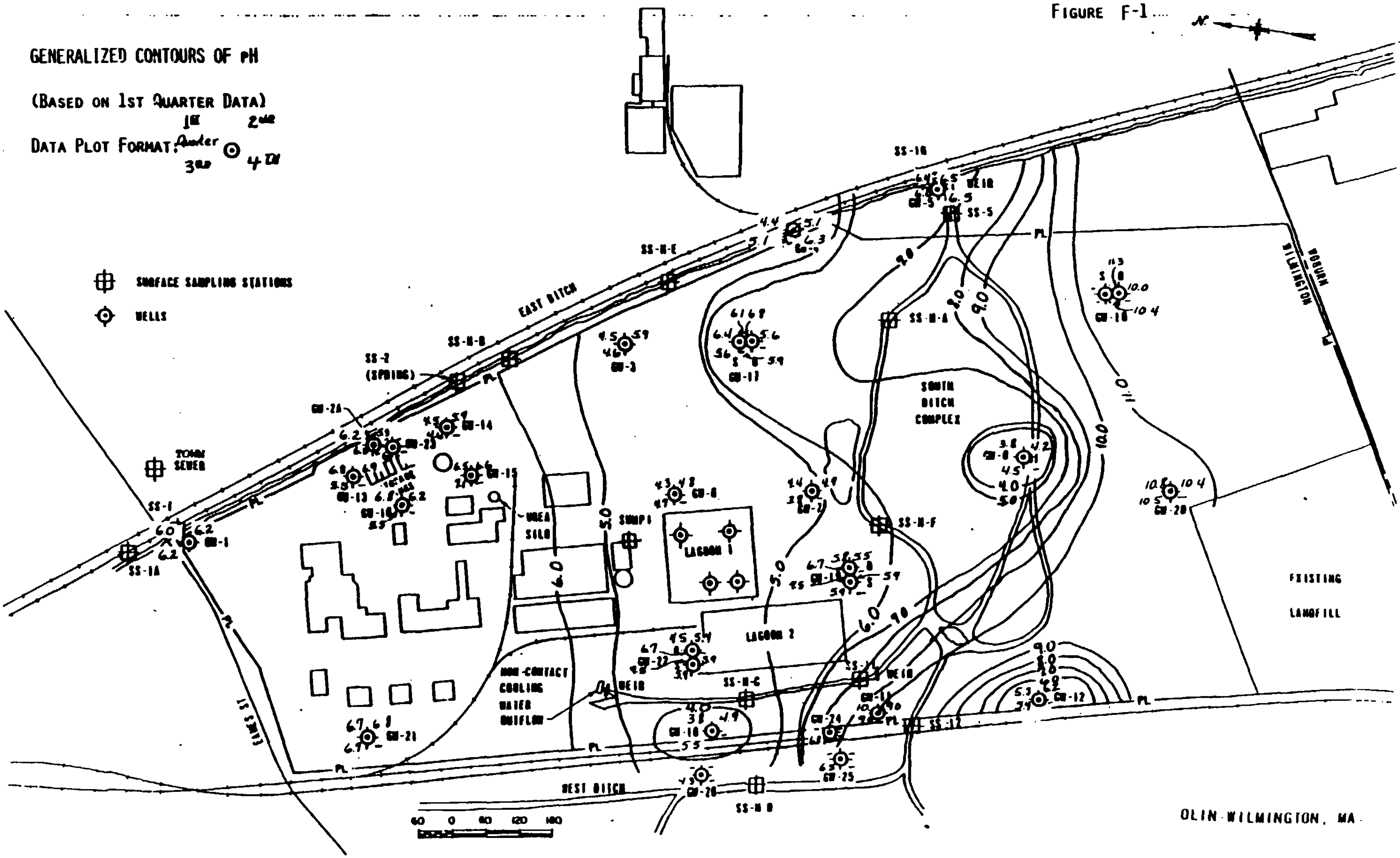
PRIORITY POLLUTANT VOLATILES
IN GROUND WATER, MG/L

APPENDIX F

CONTOUR MAPS

FIGURE F-1



GENERALIZED CONTOURS OF pH
(BASED ON 1ST QUARTER DATA)
DATA PLOT FORMAT: 1st Quarter 2nd 3rd 4th
SURFACE SAMPLING STATIONS
WELLS
EAST DITCH
WEST DITCH
SOUTH DITCH COMPLEX
LAGOON 1
LAGOON 2
UREA SILO
SUMP
NON-CONTACT COOLING WATER OUTFLOW
TOWN SEWER
EXISTING LANDFILL
WOBURN
WILMINGTON
SS-1
SS-1A
SS-2 (SPRING)
SS-5
SS-10
SS-12
SS-14
GW-1
GW-3
GW-12
GW-13
GW-14
GW-15
GW-17
GW-18
GW-19
GW-20
GW-21
GW-22
GW-23
GW-24
GW-25
GW-28
60 0 60 120 180
OLIN WILMINGTON, MA

FIGURE E-2

GENERALIZED CONTOUR OF CHLORIDE IN GROUND WATER, MG/L

(BASED ON 1ST QUARTER DATA)

DATA PLOT FORMAT:

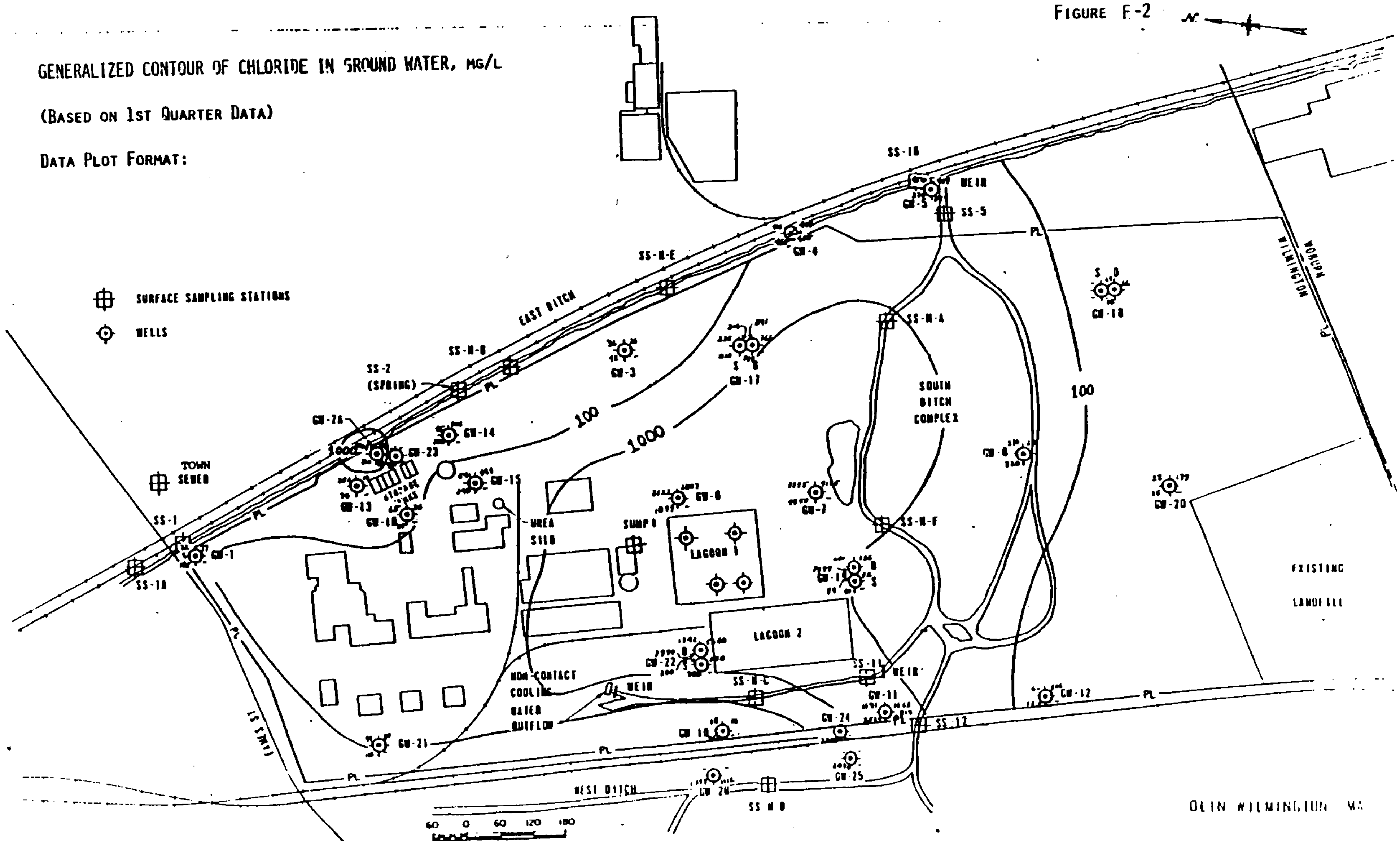


Figure F -3

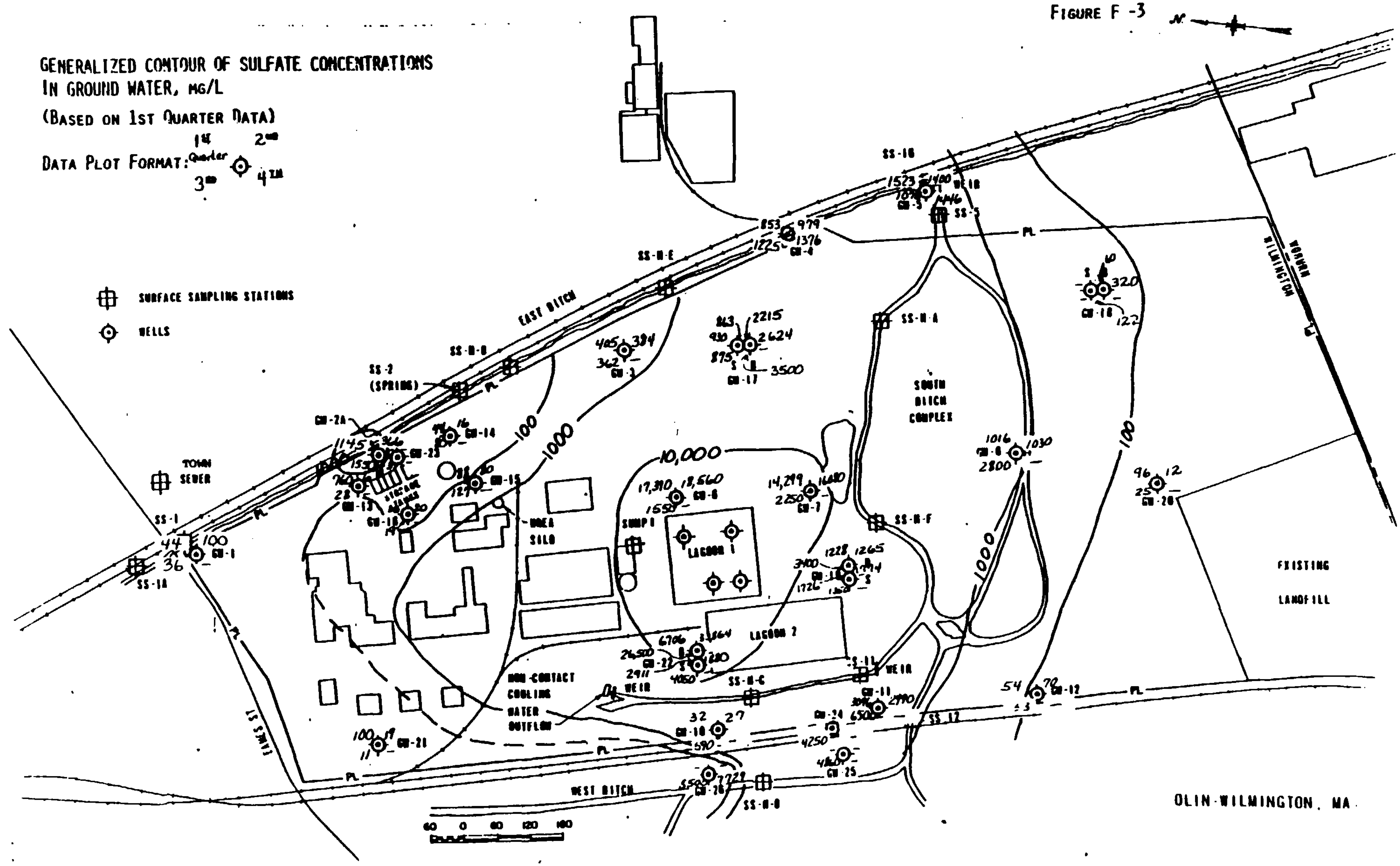
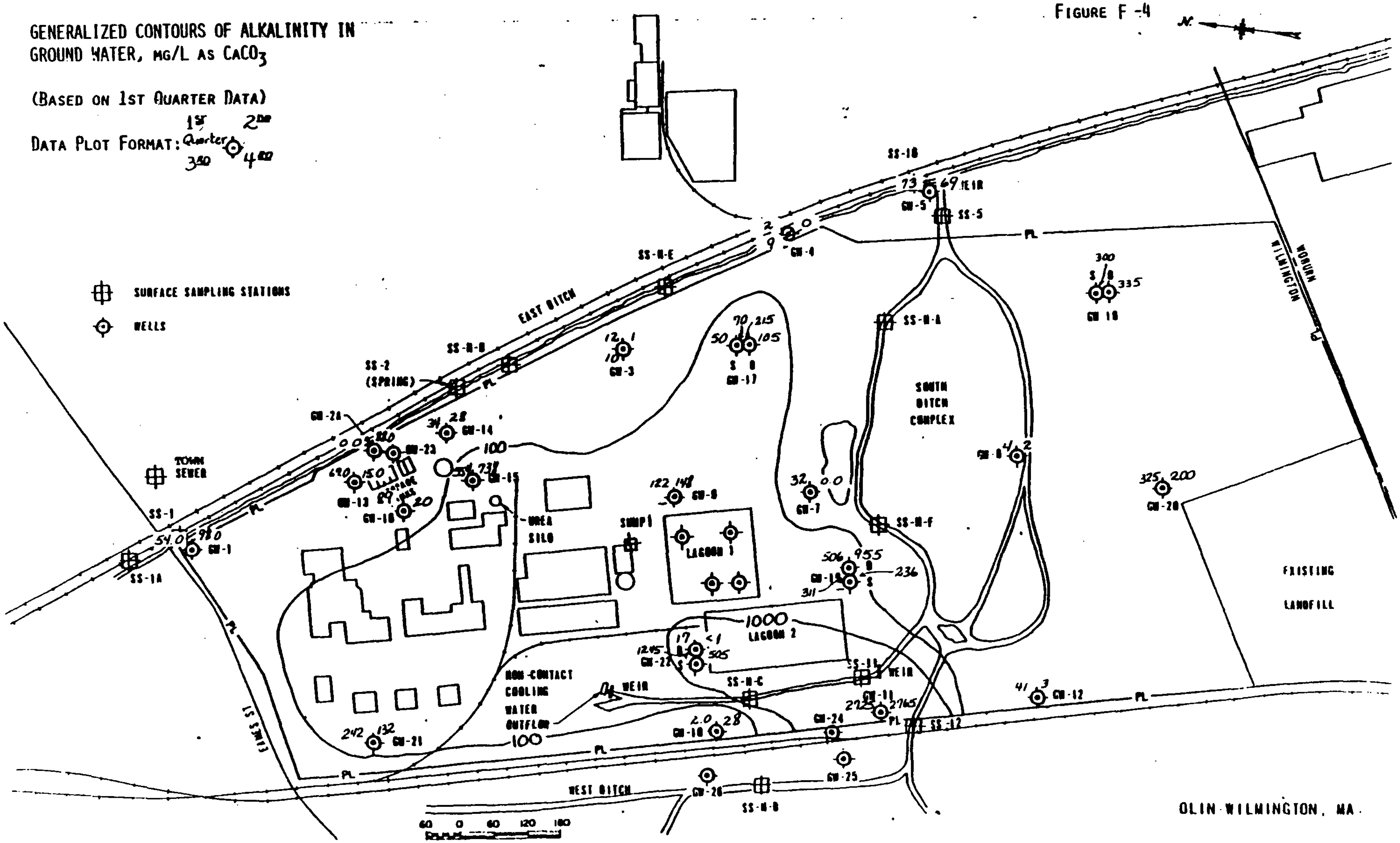

GENERALIZED CONTOUR OF SULFATE CONCENTRATIONS
IN GROUND WATER, MG/L
(BASED ON 1ST QUARTER DATA)
DATA PLOT FORMAT: 1st Quarter 2nd 3rd 4th
SURFACE SAMPLING STATIONS
WELLS
N
EAST DITCH
WEST DITCH
SOUTH DITCH COMPLEX
LAGOON 1
LAGOON 2
EXISTING LANDFILL
TOWN SEWER
UREA SILO
SUMP 1
NON-CONTACT COOLING WATER OUTFLOW
10,000
1000
100
OLIN-WILMINGTON, MA

FIGURE F-4

GENERALIZED CONTOURS OF ALKALINITY IN GROUND WATER, MG/L AS $CaCO_3$

(BASED ON 1ST QUARTER DATA)

DATA PLOT FORMAT: 1st Quarter 350, 2nd 4th

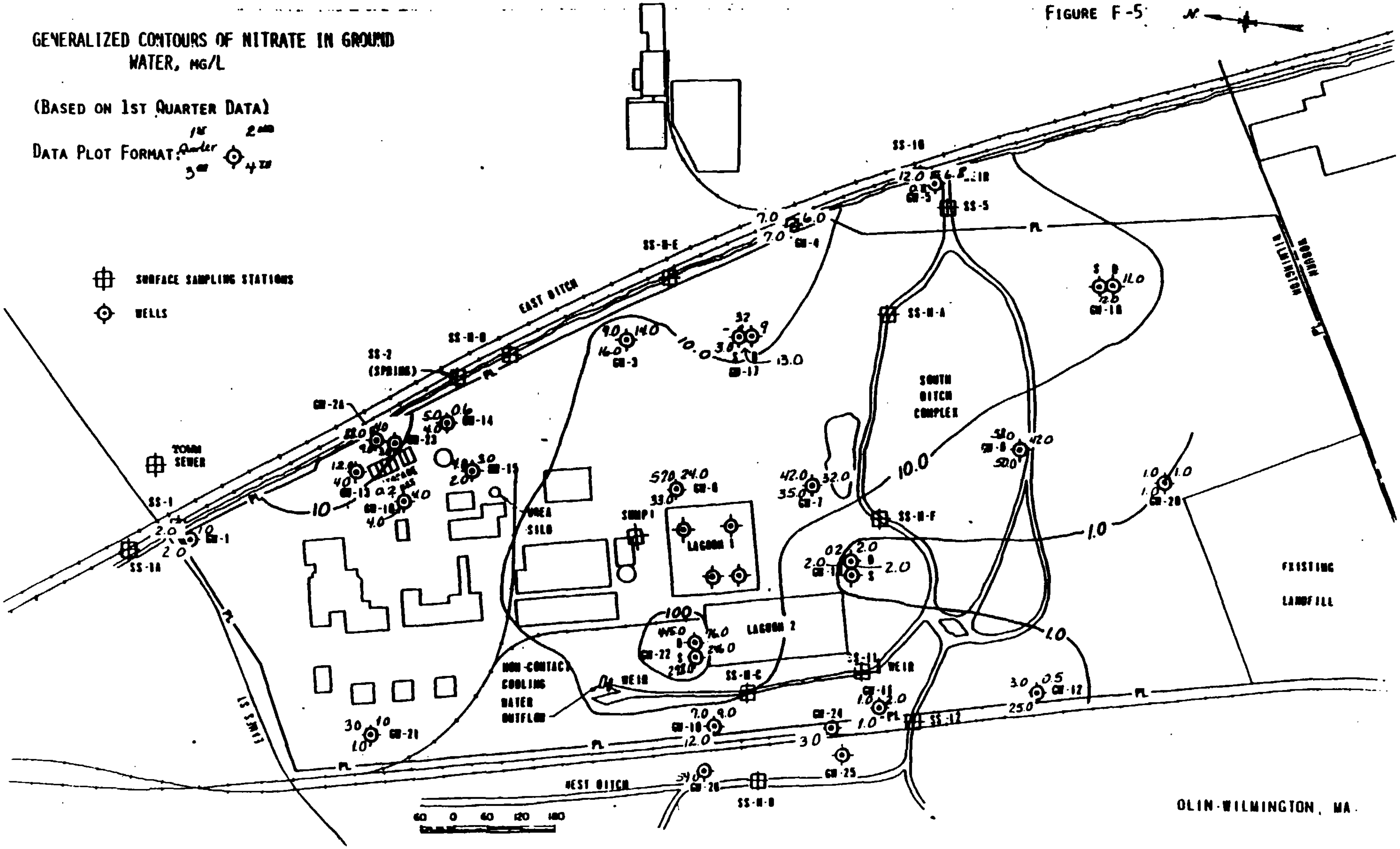


OLIN-WILMINGTON, MA.

FIGURE F-5

GENERALIZED CONTOURS OF NITRATE IN GROUND WATER, MG/L

(BASED ON 1ST QUARTER DATA)



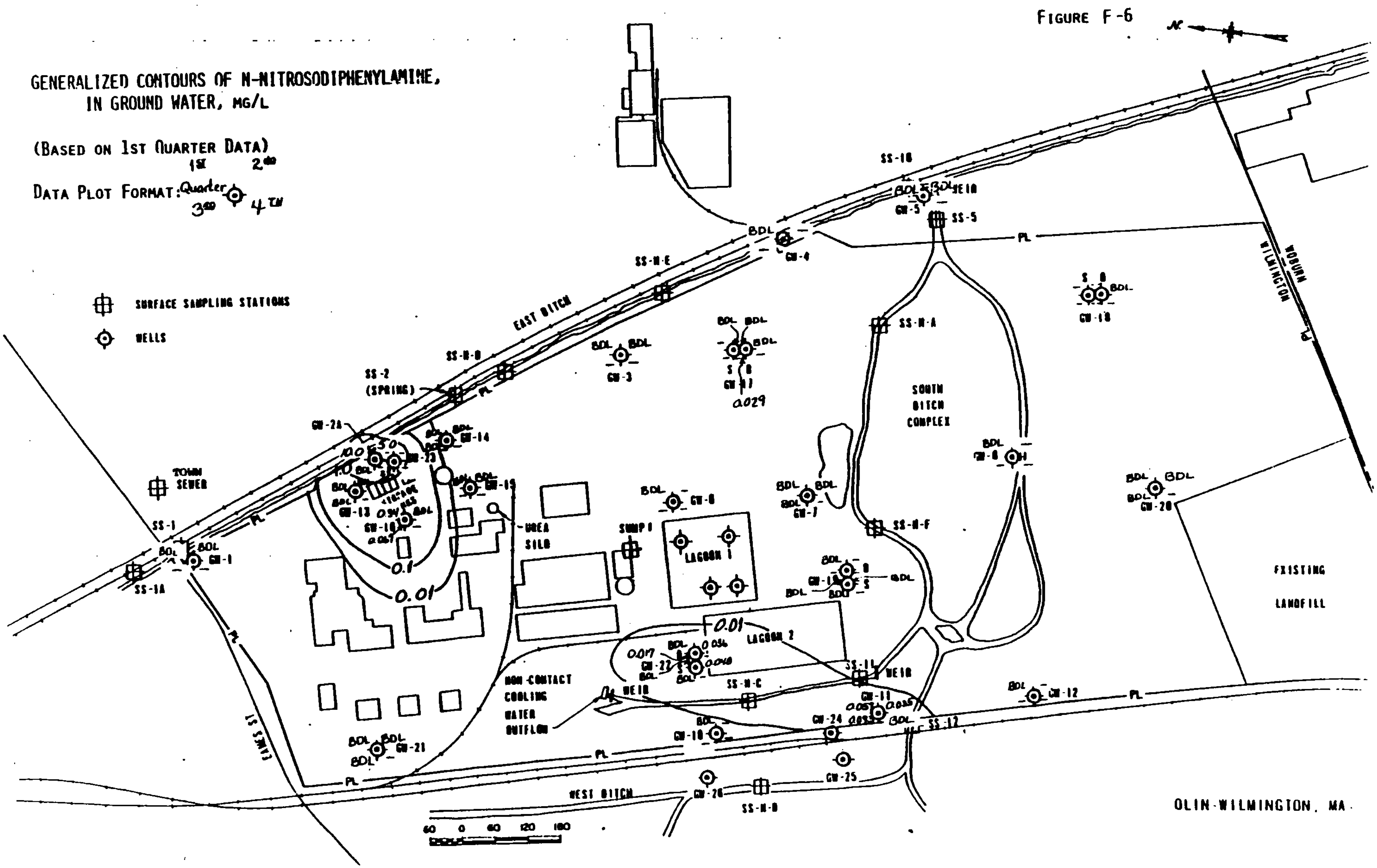


FIGURE F-6
GENERALIZED CONTOURS OF N-NITROSODIPHENYLAMINE, IN GROUND WATER, MG/L
(BASED ON 1ST QUARTER DATA)
DATA PLOT FORMAT: 1ST 2ND Quarter 3RD 4TH
SURFACE SAMPLING STATIONS
WELLS
EAST DITCH
WEST DITCH
SOUTH DITCH COMPLEX
LAGOON 1
LAGOON 2
SUMP 1
UREA SILO
TOWN SEWER
NON-CONTACT COOLING WATER OUTFLOW
EXISTING LANDFILL
WOBURN
WILMINGTON
CAMES ST
WEIR
PL
SS-1
SS-1A
SS-2 (SPRING)
SS-5
SS-10
SS-11
SS-12
GW-1
GW-2A
GW-3
GW-4
GW-5
GW-7
GW-8
GW-11
GW-12
GW-13
GW-14
GW-15
GW-18
GW-20
GW-21
GW-22
GW-23
GW-24
GW-25
GW-26
BDL
0.029
0.01
0.1
1.0
5.0
10.0
0.017
60 0 60 120 180
OLIN-WILMINGTON, MA

REFERENCE 3

4/15/77 1st con
10/4/77 meeting w/ GT/DWPC/SC
5/17/78 Progress meeting GT/DWPC/SC

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June 21, 197

Report

on

Groundwater and Surface Water Study

Stepan Chemical Company
Wilmington, Massachusetts

Presented to

Commonwealth of Massachusetts
Water Resources Commission
Division of Water Pollution Control

Submitted by

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1017 Main Street
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Project 77348

December 6, 1978

Thomas O. Keller
Thomas O. Keller
Engineer

Daniel P. LaGatta
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President

2. EXECUTIVE SUMMARY

Stepan Chemical Company, located in Wilmington, Massachusetts is a producer of organic chemicals used in the plastics industry. In the process of production, chemical waste slurry is deposited in lined lagoons for drying and subsequent removal to a landfill storage area. Prior to construction of the first lagoon in 1972, some liquid wastes were deposited in unlined pits in the area presently occupied by the lagoons. This report presents results of an investigation into suspected groundwater and surface water contamination by past and present operations of Stepan Chemical Company.

The location of the Stepan Site is shown in Fig. 1. Most of the site is drained by a ditch which borders the east property line and parallels the B&M railroad tracks. The water in this "East Drainage Ditch" flows to Hall's Brook which flows into the Aberjona River.

The Massachusetts Division of Water Pollution Control has established that the East Drainage Ditch is a Class B waterway.

The primary source of contamination of water is the East Drainage Ditch are discharges of water from an "Outlet Channel" located near the southern end of the Stepan property which drains much of the Stepan property. The secondary source of contamination to the East Drainage Ditch is infiltration of groundwater into the drainage ditch from the Stepan property.

The primary cause of contamination of surface water upstream of the Outlet Channel is believed to be the infiltration of contaminated groundwater into the drainage ditches. It is believed that contaminated groundwater results from leakage of the present treatment lagoons and remnant effects of the former "acid pits." In addition, spillage of chemicals on the ground surface of Stepan's property probably contribute to groundwater and surface water contamination.

If necessary, water in the East Drainage Ditch could be treated to achieve Class B water quality. This solution would require building a treatment facility to handle large volumes of water and would not eliminate the major sources of the pollution which are believed to be leakage from the existing lagoons and remnant contamination from the former "acid pits."

The lagoons could be eliminated as a source of pollution by either 1) redesigning the lagoons with a high factor of safety against leakage or 2) developing a waste treatment system which did not require use of lagoons. Remnant contamination from the former "acid pits" could be partially controlled by surrounding the contaminated area with an impervious cutoff wall at an estimated cost of $225,000.

3. SURFACE CONDITIONS

3.1 Plant Layout and Operation

The chemical plant operations began in 1953 under the ownership of National Polychemicals, Inc. (NPI). In June 1971, NPI merged with Stepan Chemical Company and the chemical plant name was changed to Stepan Chemical Company.

The plant structures occupy the northern portion of the project site, as shown in Fig. 2. According to Stepan personnel, untreated effluent from the plant operation was discharged into "acid pits" (see Fig. 2) from sometime prior to 1965 up until July 1971. From July 1971 to February 1972, treated effluent was discharged into the "acid pits." The location of the "acid pits" was taken from a design drawing entitled "Layout Lined Disposal Area, National Polychemicals, Inc., Wilmington, Mass." by Dana F. Perkins and Sons, Inc. dated September 2, 1971.

The chemical composition of discharges into the "acid pits" could not be determined, but it is believed that the liquids had low pH. The "acid pits" were not lined, and therefore, discharges were free to enter the groundwater. According to an aerial photograph taken April 24, 1971 (by Col-East, Inc. for Dana F. Perkins and Sons, Inc.), a drainage ditch connected the "acid pits" to a small pond in the center of Stepan's property (see Fig. 2 and Section 3.2), which in turn discharges into a drainage ditch labeled the North Drainage Ditch on Fig. 2. During periods of high waste discharge or heavy rainfall, it is believed that contaminated water in the "acid pits" flowed into drainage ditches which eventually discharge into the East Drainage Ditch running between Stepan's east property line and the B&M railroad (see Fig. 2). In addition, during periods of very high flow, it is believed that contaminated water could overflow drainage ditches leading to the East Drainage Ditch. It is believed that the presently observed dead trees in the area southeast of the "acid pits" are the result of contaminated overflows from the "acid pits" and/or contaminated groundwater flow due to discharges from the acid pits.

The Massachusetts Water Resources Commission Division of Water Pollution Control was established in 1967. This Commission required Stepan to implement a waste treatment program to eliminate discharges of effluent into the acid pits.

4. *SUBSURFACE CONDITIONS*

4.1 Subsoils

Twelve borings were made at the project site to determine subsoil conditions. Groundwater wells were installed in 11 of these borings at locations shown in Fig. 2. Appendix A contains the groundwater-well installation report for each boring. A well was not installed in Boring 9 at the northwest corner of Stepan's property because of shallow bedrock at this location. An existing groundwater well, designated W-101, was discovered near Lagoon 1 on May 31, 1978. This well was used for both groundwater sampling and groundwater elevation measurements.

The borings indicate that the general soil profile at the site is 3 to 15 ft of layered fine to coarse sands, occasionally mixed with gravel and/or silt, over a layer of predominantly sandy gravel and gravelly sand, occasionally containing silt. An estimate of horizontal soil permeability was made by conducting an in situ falling head permeability test in each groundwater well installed by GEI. Values of horizontal soil permeability are given in the groundwater installation reports in Appendix A. Horizontal soil permeabilities range from 0.01 cm/sec to 0.0001 cm/sec, the average for the 11 wells being 0.007 cm/sec.

The boring in the northwest corner of Stepan's property (Boring 9) indicated rock at a depth of 5 ft. Boring refusal was met in eight borings at depths ranging from 10.2 to 21.2 ft. Since rock was not cored, boring refusal may indicate the presence of a boulder. Boring refusal was not met in Boring Nos. 5, 10, and 11, which were made to depths ranging from 12.0 ft to 24.0 ft.

4.2 Groundwater

Groundwater elevations in each groundwater well are given in Table 18. Fig. 4 is a plot of groundwater elevation vs. time for each well. The average groundwater elevation for each well from November 2, 1977 to May 31, 1978 was obtained from the curves of Fig. 4 and is given in the last column of Table 18. The maximum groundwater elevation occurred between late February and early April of 1978 which corresponds to the period of snow melting as shown by the Climatological Data in Fig. 3. Groundwater elevations fluctuated on the order of about one foot during the sampling period. Generally, the fluctuation in the wells paralleled each other (Fig. 4) which indicates that the pattern of groundwater elevation contours is similar for high and low groundwater levels at the site.

A groundwater-elevation contour map was made from the average groundwater elevations for each well and is shown in Fig. 5. Groundwater elevations between two wells were determined by linear interpolation of the groundwater elevations in each well. The actual groundwater elevations between wells may vary from those shown in Fig. 5. It was assumed that the groundwater elevations adjacent to the East Drainage Ditch were the same as the water elevations in the ditch. Direction of groundwater flow is from higher to lower elevation and is perpendicular to groundwater contour lines.

Sufficient data are not available to draw contours in the northwest portion of the site, and the contour lines have been extrapolated as dotted lines in this area as shown in Fig. 5.

At GW-10, GW-11 and GW-12, the groundwater elevations are similar, and it is not possible on the basis of existing groundwater elevation data to accurately determine the direction of flow in this area.

Cross sections through the site are shown in Fig. 6 and 7. Fig. 2 shows the location of each cross section. Average groundwater elevations in wells have been plotted and elevations of water in drainage-ways are plotted as measured on April 14, 1978. The groundwater level in the wells for this date are reasonably close to the average levels. The bottom elevations of the lagoon liners were taken from design drawings of the liners referenced in Chapter 6.

On May 31, 1978, water was standing in Lagoon 2 and water was not seen at the surface of Lagoon 1. Both lagoons appeared filled with sludge throughout the groundwater sampling period. The cross sections show that (1) the groundwater surface outside the lagoons is above the design elevation of the bottom of both lagoon liners and (2) water in Lagoon 2 is at a higher elevation than the surrounding groundwater.

It was not possible on the basis of the existing groundwater elevation data to determine if waters in the lagoons are creating localized increases in the groundwater surface elevation near the lagoons.

4.3 Groundwater Flow into Drainage Ditches

4.3.1 Flow into the East Drainage Ditch

The average groundwater elevations in Wells GW-2 through GW-5, which are located within 15 to 90 ft of the East Drainage Ditch, are higher than the elevation of the water surface in the East Drainage Ditch measured on May 31,

5. ANALYTICAL RESULTS

5.1 General

All water quality tests were performed by ECO, Inc. of Cambridge, Massachusetts. Water samples were analyzed for pH, acidity, sulfate, chloride, ammonia, and dissolved solids. All samples were delivered to ECO, Inc. on the same day that they were taken and analyzed for pH and acidity within two hours after delivery. Samples of sludge from the lagoons were also analyzed by ECO, Inc.

5.2 Lagoon Samples

On May 31, 1978, a sample of water from Lagoon 2 was obtained by Stepan personnel under the supervision of GEI; analytical results for this sample are presented in Table 14 which shows that the lagoon water has a pH of 1.4 and has high concentrations of all other parameters tested. The low pH of water in Lagoon 2 is unusual in that normal operations of the waste treatment facility should create a sludge with a pH >7.

On May 31, 1978, sludge was taken for analysis from Lagoon 1 and from a small lined basin north of Lagoon 2 by GEI with the aid of Stepan personnel. The small basin was constructed between April 14, 1978 and May 31, 1978. Details of the design of this basin are not known to GEI. According to Stepan personnel, sludge in the basin was taken from Lagoon 2, and it will be referred to in this report as sludge from Lagoon 2. The analytical results for the sludge samples are presented in Table 15 which shows that sludge from Lagoon 1 has a pH of about 10 and the sludge from Lagoon 2 has a pH of about 5.

As stated in Section 3.1, sludge remains in the lagoons until it has air dried sufficiently to be removed. Stepan personnel have observed that the sludge in the lower portion of the lagoons remains in a wet state and have attributed this wetness to insufficient evaporation of water from the sludge. Another possible explanation for this wetness is that there are leaks near the bottom of the liners, and since the groundwater surface is above the bottom of the liners, these leaks allow groundwater to enter the lagoon. If this were the case, the sludge would remain in a wet state higher than the groundwater surface elevation because of capillary tension.

A grain-size analysis of the sludge from Lagoon 2 was made to obtain an estimate of the height of capillary rise in the sludge material. The grain-size curve of the sludge is shown in Fig. 20. The sludge is predominantly silt-sized. The height of the capillary rise in a silt having the grain-size characteristics shown in Fig. 20 is approximately 3.0 to 3.5 ft. If groundwater were in direct communication with the sludge in a lagoon and the sludge behaved similarly to a silt with respect to capillary rise, then the sludge would probably be wet in the lower 3 to 6 ft of the lagoon because of capillary rise of the groundwater.

5.3 Groundwater

The analytical results of groundwater samples taken from November 11, 1977 to May 31, 1978 are shown in Tables 1 through 6. Average analytical results for each well are shown in Table 13. The data summarized in Table 13 indicates that a wide range of groundwater quality exists on the project site. To establish if isolated zones of high chemical concentration are present on the site, the areal distributions of each groundwater quality parameter were plotted. These distribution plots are shown Figs. 8 through 13.

The areal distribution of pH was plotted by assigning to each well the average measured pH for the sampling period (average values are given in Table 13 and Fig. 8). The pH of water between two wells was assumed to vary linerly between wells. Lines of equal pH were then drawn. Distribution lines were not drawn around GW-1 and GW-2 because they are relatively isolated from the other wells.

The areal distribution of the remaining five water quality parameters were determined similarly except that values of the distribution lines represent the logarithm (base 10) of the concentration. The logarithm method was used so that transitions from high to low concentration would be smooth.

The following sections consider the areal distribution plots of each parameter in more detail.

5.3.1 pH

The areal distribution of pH, Fig. 8, indicates that pH changes from above 7 to below 4 within about 200 ft in the vicinity of the lagoons. The average pH for wells GW-6 and GW-11 was 8.0 and 7.9, respectively. All other wells had an average pH below 7, the lowest pH being 3.4 in Well W-101.

On May 31, 1978 the water in Lagoon 2 had a pH of 1.4 and the sludge in Lagoon 1 had a pH of about 10.1.

The variable pH of the groundwater could be due in part to the following:

1) Discharge of wastes into Lagoon 2 if the PVC liner of Lagoon 2 was leaking. Presently, there is water with pH = 1.4 in Lagoon 2; we have no record of past water quality in Lagoon 2.

2) Discharge of wastes into Lagoon 1 if the PVC liner of Lagoon 1 was leaking. Presently, the material in Lagoon 1 has a high pH.

3) Discharges of effluent into the "acid pits" prior to 1971; this effluent may still be affecting the pH of the groundwater. It is believed that acids were discharged into the pits (hence "acid pits") and that this effluent had low pH.

5.3.2 Acidity

The areal distribution of acidity is shown in Fig. 9. Average acidity of groundwater varies from 32 (acidity is expressed in mg/ℓ as $CaCO_3$) in GW-12 to 6,928 in W-101.

The highest acidity is in the vicinity of the lagoons. The acidity of water in Lagoon 2 on May 31, 1978 was 7,217. The acidity tends to decrease from the lagoons towards the drainage ditches.

A possible explanation for the highly acidic groundwater near the lagoons is that the water inside Lagoon 2 is leaking through the PVC liner. If Lagoon 1 contained acidic water in the past and the liner was leaking, it too could be a possible source of the present high acidity in the groundwater. Another possible explanation is that discharge of effluent into the "acid pits" prior to 1971 created a load of highly acidic material beneath the present lagoons; this load may still be contaminating the groundwater.

5.3.3 Sulfate

The areal distribution of sulfate is shown in Fig. 10. Average concentration of sulfate varies from 7 (sulfate concentration is expressed in mg/ℓ as SO_4^{-2}) in GW-10 to 15,000 in W-101. The zone of highest concentration is in the vicinity of the lagoons. The sulfate concentration of water in Lagoon 2 on May 31, 1978 was 15,600.

A possible explanation for the high sulfate concentration in the groundwater near the lagoons is that either or both of the lagoons are leaking. Another possibility is that dischage of an acid, for example H_2SO_4 into the "acid pits" prior to 1971 is still affecting the groundwater quality in the area.

5.3.4 Chloride

The areal distribution of chloride is shown in Fig. 11. Average concentration of chloride varies from 33 (chloride concentration is expressed in mg/ℓ as Cl^-) in GW-10 to 5,100 in GW-7. The zone of highest concentration includes the lagoon area and areas southeast and southwest of the lagoons. The chloride concentration of water in Lagoon 2 on May 31, 1978 was 4,750.

A possible explanation for the high chloride concentration in the groundwater near the lagoons is that either or both of the lagoons are leaking. It is possible that discharge of an acid, for example HCl, into the "acid pits" prior to 1971 is still affecting the groundwater quality in the area.

5.3.5 Ammonia

The areal distribution of ammonia is shown in Fig. 12. Average concentration of ammonia varies from 1 (ammonia concentration is expressed in mg/ℓ as NH_4Cl) in GW-10 and GW-12 to about 17,200 in GW-6 and GW-11. The latter average concentrations are affected by an unusually high ammonia measurement of about 60,000 in each well on December 8, 1977. If the unusually high ammonia measurement is not included in the average, then the average ammonia concentration in GW-6 and GW-11 is about 5,300. The zone of highest concentration is between GW-6 and GW-11 and extends over the location of the lagoons. The ammonia concentration of water in Lagoon 2 on May 31, 1978 was 4,700.

A possible explanation for the high ammonia concentration in the groundwater near the lagoons is that either or both of the lagoons is leaking. It is not known if ammonia was ever discharged into the "acid pits."

5.3.6 Dissolved Solids

The areal distribution of dissolved solids concentration is shown in Fig. 13. Average concentration of dissolved solids varies from about 42 (dissolved solids concentration is expressed in mg/ℓ as $CaCO_3$) in GW-10 and GW-12 to about 7,500 in GW-7 and W-101. The zone of highest concentration covers the lagoon area and portions southeast and southwest of the lagoons. This distribution is similar to that shown by the chloride concentration (see Section 5.2.4). The dissolved solids concentration in water in Lagoon 2 on May 31, 1978 was 11,000.

A possible explanation for the high dissolved solids concentration in the groundwater near the lagoons is that either or both of lagoons are leaking. Another possiblity is that discharge of effluent into the "acid pits" prior to 1971 caused an increase in the dissolved solids concentration near the lagoons which is still contaminating the groundwater.

5.3.7 Summary

The areal distributions of each groundwater quality parameter were plotted and are shown in Figs. 8 through 13. This section is intended to present a summary of these figures so that consistent trends can be shown.

A trend which is evident in the distribution plots is that a zone of high chemical concentration exists in the vicinity of the lagoons which is also the location of the former "acid pits." The pH distribution is an exception in that the pH of the groundwater varies from about 4 to 7 in the vicinity of the lagoons, apparently independent of the lagoon locations. The quality of water inside Lagoon 2 on May 31, 1978 was similar to the quality of surrounding groundwater except for pH as noted above. The groundwater quality can be attributed to leakage of the lagoons. However, remnant loads of contaminants from discharges into the "acid pits" prior to 1971 may still be affecting the groundwater quality in the area. ?

GW-10 and GW-12 have relatively low concentrations of chemicals while GW-11 has high concentrations. The groundwater flow in this area is difficult to define explicitly because the variation of groundwater elevation in this area is so small that several interpretations of the flow pattern are possible. If Lagoon 2 were leaking, then local variations of groundwater flow might exist such that GW-11 received contaminated groundwater, while GW-10 and GW-12 received relatively uncontaminated groundwater.

5.4 Surface Water

The analytical results of surface water samples taken from December 8, 1977 to April 10, 1978 are shown in Tables 7 through 12. These tables indicate that a wide range of surface water quality exists on the project site.

5.4.1 East Drainage Ditch

In order to establish the cause(s) of contaminated water in the East Drainage Ditch, each surface water quality parameter was plotted as a function of its location on the East Drainage Ditch. The appropriate groundwater quality parameter was put on the same plot at locations of wells along Stepan's east boundary. These plots were made for each sampling time during this investigation and are shown on Figs. 14 through 19; each figure represents a different water quality parameter. The following sections consider these figures in more detail.

5.4.1.1 pH

A plot of pH of water along the east boundary of Stepan's property is shown on Fig. 14.

Figure 14 shows that pH varied between 5.5 and 6.5 at SS-1 and varied between 5.6 and 6.4 at SS-7 for all of the sampling times. Therefore, the pH of water in the East Drainage Ditch did not change appreciably as it flowed from the northern end to the southern end of Stepan's property, and in some cases, the pH improved, i.e., it moved toward neutrality. The pH of water in the ditch changed sharply where discharges from the Outlet Channel entered the ditch flow. However, the change varied between an increase and a decrease in pH and the change was never more than about 0.8.

The pH of the groundwater along Stepan's east boundary shows a change between GW-1 and GW-5. Wells GW-1, GW-2, and GW-5 consistently show a pH of about 6, while Wells GW-3 and GW-4 consistently show a pH of about 4.3. However, the lower pH of the groundwater near GW-3 and GW-4 does not cause the pH of the East Drainage Ditch water to decrease significantly (see Fig. 14) even though groundwater infiltrates into the ditch. Groundwater flow into the East Drainage Ditch is probably a small percentage of the total flow in the ditch, except during dry periods.

5.4.1.2. Acidity

A plot of acidity along the east boundary of Stepan's property is shown in Fig. 15. All acidity measurements are expressed in mg/ℓ as $CaCO_3$.

Figure 15 shows that acidity of the East Drainage Ditch water varied between 30 and 59 at SS-1 and varied between 80 and 177 at SS-7 for all of the sampling times. Therefore, there was a consistent increase in acidity of water in the East Drainage Ditch as it flowed from the northern end to the southern end of Stepan's property. A large portion of this increase was due to discharges from the Outlet Channel, the largest increase in acidity from these discharges being 94 on March 15, 1978.

The acidity of groundwater in the wells along Stepan's east boundary shows a general trend from GW-1 to GW-5. Acidity of the groundwater taken from the wells is many times greater than the acidity of the drainage ditch water and tends to be highest near the center of the site, from GW-2 to GW-4. Infiltration of contaminated groundwater into the East Drainage Ditch is probably responsible for the measured increases in acidity of between 5 and 25 in the drainage ditch water as it flows from SS-1 to SS-16.

5.4.1.3 Sulfate

A plot of sulfate concentration in the water along the east boundary of Stepan's property is shown in Fig. 16. All sulfate concentrations are expressed in mg/ℓ as SO_4^{-2}.

Figure 16 shows that sulfate concentration in the East Drainage Ditch water varied between 12 and 37 at SS-1 and varied between 240 and 700 at SS-7 for all of the sampling times. Therefore, there was a consistent increase in the concentration of sulfate in the East Drainage Ditch water as it flowed from the northern end to the southern end of Stepan's property. A large portion of this increase was due to discharges from the Outlet Channel, the largest increase in sulfate concentration from these discharges being 420 on March 15, 1978.

Figure 16 shows that sulfate concentration in the groundwater taken from wells along Stepan's east boundary is much greater than the sulfate concentration in water of the East Drainage Ditch. Groundwater concentrations are lowest for GW-1 and GW-2 and tend to be high for GW-3, GW-4 and GW-5. Infiltration of contaminated groundwater into the East Drainage Ditch is most likely responsible for measured increases in sulfate concentration of between 42 and 133 in the drainage ditch water as it flows from SS-1 to SS-16.

5.4.1.4 Chloride

A plot of chloride concentration in the water along the east boundary of Stepan's property is shown in Fig. 17. All chloride concentrations are expressed in mg/ℓ as Cl^-.

Figure 17 shows that chloride concentration in the East Drainage Ditch water varied between 37 and 200 at SS-1 and varied between 185 and 400 at SS-7 for all of the sampling times. On the average, for each sampling time, there was a five-fold increase in chloride concentration in the ditch water as it flowed from SS-1 to SS-7. The largest portion of this increase was due to discharges from the Outlet Channel, the largest increase in chloride concentration from these discharges being 180 on March 15, 1978.

Figure 17 shows that the chloride concentration in the groundwater taken from wells along Stepan's east boundary is always greater than the chloride concentration in water of the East Drainage Ditch. However, there has been a trend from November 11, 1977 to April 10, 1978 for the chloride concentration in the groundwater to decrease; on April 10 the chloride concentration in the groundwater and surface water were similar. Infiltration of contaminated groundwater into the East Drainage Ditch is probably responsible for the measured increases in chloride concentration of between 33 and 100 in the drainage ditch water as it flows from SS-1 to SS-16.

5.4.1.5 Ammonia

A plot of ammonia concentration in the water along the east boundary of Stepan's property is shown in Fig. 18. All ammonia concentrations are expressed in mg/ℓ as NH_4Cl.

why?

Figure 18 shows that ammonia concentration in the East Drainage Ditch water varied between 0.5 and 7 at SS-1 and varied between 270 and 780 at SS-7 for all of the sampling times. Therefore, there was a consistent increase in the concentration of ammonia in the East Drainage Ditch water as it flowed from the northern end to the southern end of Stepan's property. The most significant cause of this increase was the discharge from the Outlet Channel which increased the ammonia concentration of the ditch water by at least 245 each sampling time.

Figure 18 shows that the ammonia concentration in the groundwater taken from wells along Stepan's east boundary is consistently greater than the ammonia concentration in water of the East Drainage Ditch. GW-1 consistently has the lowest ammonia concentration of the wells along the east property boundary. The ammonia concentration tends to increase from GW-2 to GW-4 and then drops at GW-5. Infiltration of contaminated groundwater into the East Drainage Ditch is probably responsible for the measured increases in ammonia concentration of between 24 and 61 in the drainage ditch water as it flows from SS-1 to SS-16.

5.4.1.6 <u>Dissolved Solids</u>

A plot of dissolved solids concentration in the water along the east boundary of Stepan's property is shown in Fig. 19. All dissolved solids concentrations are expressed in mg/ℓ as $CaCO_3$.

Figure 19 shows that dissolved solids concentration in the East Drainage Ditch water varied between 81 and 130 at SS-1 and varied between 405 and 775 at SS-7 for all of the sampling times. Therefore, there was a consistent increase in the concentration of dissolved solids in the East Drainage Ditch water as it flowed from the northern end to the southern end of Stepan's property. This increase was partly due to the discharges from the Outlet Channel which caused increases in concentration as high as about 650.

Figure 19 shows that the dissolved solids concentration in the groundwater taken from wells along Stepan's east boundary is consistently greater than the dissolved solids concentration in water of the East Drainage Ditch. Dissolved solids concentration in the groundwater is generally lowest at GW-1 and GW-2 and tends to increase in GW-3, GW-4, and GW-5. Infiltration of contaminated groundwater into the East Drainage Ditch is probably responsible for the measured increases in dissolved solids concentration of between 55 and 104 in the drainage ditch water as it flows from SS-1 to SS-16.

5.4.1.7 Summary

This section summarizes the trends observed from analytical results of surface water and groundwater samples along the east boundary of Stepan's property, i.e., the East Drainage Ditch samples and groundwater samples from GW-1 to GW-5. These analytical results have been plotted for each water quality parameter in Figs. 14 through 19.

These figures show that water in the East Drainage Ditch becomes more contaminated as it passes from Stepan's north property line to Stepan's south property line. The major cause for this contamination is the discharge into the East Drainage Ditch from the Outlet Channel. In addition, Figs. 15 through 19 show that water in the East Drainage Ditch gradually becomes more contaminated as it flows from Stepan's north property line to the Outlet Channel (SS-1 to SS-16). Figure 14 shows that pH of water in the East Drainage Ditch remains either unchanged or becomes slightly more neutral from SS-1 to SS-16.

The gradual change in water quality from SS-1 to SS-16 can be attributed to groundwater infiltration into the East Drainage Ditch. Concentrations of all parameters, except pH, in the groundwater are considerably higher than concentrations in the East Drainage Ditch water as shown by Figs. 14 through 19. Therefore, a small amount of groundwater flow into the ditch can noticeably raise the chemical concentrations in the ditch water.

On the basis of groundwater elevation measurements and surface water elevation measurements, it has been concluded that groundwater from the Stepan property flows into the East Drainage Ditch (see Section 4.3.1). An attempt was made to determine the quantity of flow in the East Drainage Ditch caused by groundwater flow into the ditch. An accurate determination of this quantity could not be determined for the following reasons:

1) Based on in situ permeability measurements and the assumed hydraulic gradient, the quantity of groundwater flow is small.

2) The flow of water in the East Drainage Ditch was too small to measure accurately; hence the difference in flow at the north and south boundaries could not be used to estimate the groundwater flow.

5.4.2 Outlet Channel

The increase in contamination of water in the East Drainage Ditch from Stepan's north property line to Stepan's south property line (SS-1 to SS-7) is mainly due to discharges into the ditch from the Outlet Channel.

Figure 21 shows the major drainage-ways upstream of the Outlet Channel and the surface sampling stations on these drainage ways. To trace sources of pollution upstream of the Outlet Channel, the ammonia concentrations of water upstream of the Outlet Channel on April 10, 1978 were considered (these ammonia concentrations are given in Table 11). The ammonia concentrations, expressed in mg/ℓ as NH_4Cl, are shown on Fig. 21 next to the appropriate surface sampling stations.

The sampling locations farthest upstream of the Outlet Channel are the Headwall on the West Drainage Ditch (SS-10) and the West Pond (SS-15) which is west of the Stepan property line. These two locations show relatively low concentrations of ammonia.

Water flows from the West Pond to SS-12 on Stepan's property. Sampling Station SS-12 is just inside the Stepan property line about 300 ft downstream of the West Pond. In this distance, the ammonia concentration increases from 3 at SS-15 near the West Pond to 550 at SS-12, which is believed to be caused by contaminated groundwater infiltrating into the drainage ditch downstream of SS-15. In Section 4.3.2, it was established that the elevation of the groundwater in the area of SS-12 was higher than the elevation of the drainage ditch water, and hence groundwater infiltration into the ditch near SS-12 does occur. The groundwater well in this area (GW-11) typically has very high concentrations of ammonia.

Water flows from SS-12 to the junction of the North and South Drainage Ditches. At this junction, part of the water flows into the North Drainage Ditch and part flows into the South Drainage Ditch. As water flows from SS-12 to a point 200 ft downstream on the South Drainage Ditch (SS-14), the ammonia concentration increases from 556 to 630. This increase is probably due to infiltration of contaminated groundwater

6. LAGOONS

Information on the design and construction of the lined lagoons at Stepan Chemical Company has been difficult to obtain because of the lack of documentation. This chapter is intended to (1) provide information on the lagoons made available to GEI, (2) document observations made by GEI of the lagoon performance, and (3) arrive at conclusions of the liner integrity.

Construction of Lagoon 1 was completed in January 1972, and construction of Lagoon 2 was completed sometime in 1973. Information on the lagoon design was obtained from two drawings, both entitled "Layout Lined Disposal Area, National Polychemicals, Inc., Wilmington, Mass.," by Dana F. Perkins and Sons, Inc., dated September 2, 1971 and June 28, 1973. These drawings show that the lagoons were to be constructed at the location of the former "acid pits" (see Fig. 2). The bottoms of the liners were to be placed on natural ground and the sides of the liners were to be placed on either natural ground or a fill layer. The drawings show that a polyvinyl chloride (PVC) liner was to be used for Lagoon 1; no mention of liner type was given for Lagoon 2. The liner type was determined to be PVC for both lagoons through discussions with Stepan Chemical Company personnel. The thickness of the liners was measured in the field by GEI (at an exposed portion) and found to be 0.020 in. (20 mil) thick. The design drawings indicate that the liners were to be exposed at the ground surface and that no protective layer was to be placed on top of the liner sides or bottom. Field observations by GEI confirm that the lagoon liners are exposed at the surface and that exposed portions are in varying degrees of deterioration. Tears and holes in portions of the liners exposed at the ground surface have been observed.

The manufacturer of the PVC liners was determined from Stepan personnel to be Firestone Coated Fabric Co. Firestone personnel indicated that they no longer sell liners of the type used at Stepan Chemical Company. Firestone could not provide GEI with specific information on the PVC liners installed at Stepan. Stepan personnel indicated that construction of Lagoon 1 was inspected by a representative of Firestone but that no construction records for the lagoon could be found. According to Stepan personnel, the liners were placed on natural ground which had been cleared of large stones. According to Dana F. Perkins and Sons, Inc. personnel, the groundwater table was lowered to allow construction of the lagoons in a dry excavation. The details of the dewatering system and groundwater elevation records during construction could not be found.

TABLE 7 - ANALYTICAL RESULTS OF SURFACE WATER SAMPLES
STEPAN CHEMICAL COMPANY
WILMINGTON, MASSACHUSETTS

pH(1)

Surface Sampling Station No.	1977 Dec 8	1978 Jan 19	1978 Feb 21	1978 Mar 15	1978 Apr 10
SS-1	6.3	6.5	6.2	5.7	5.5
SS-2	6.3	6.4	6.3	-	-
SS-3	6.1	6.4	6.2	5.7	5.8
SS-4	6.3	6.5	(2)	5.7	5.9
SS-5	4.9	5.1	(2)	4.9	6.7
SS-6	5.7	5.6	6.4	5.4	6.1
SS-7	5.8	5.8	6.3	5.6	6.1
SS-8	4.9	(2)	(2)	5.5	6.8
SS-9	(2)	(2)	(2)	(2)	5.2
SS-10	6.2	7.1	9.8	8.1	8.4
SS-11	6.2	7.3	9.4	6.5	7.7
SS-12	4.4	4.7	4.6	4.2	4.1
SS-13	-	(2)	(2)	(2)	4.0
SS-14	-	(2)	(2)	(2)	4.2
SS-15	-	(2)	(2)	5.3	4.4
SS-16	-	-	-	5.7	5.8
SS-17	-	-	-	6.1	-

Notes:

(1) This analysis was carried out using the method described in *Standard Methods for the Examination of Water and Wastewater*, 13 ed., Am. Public Health Assoc., Washington, DC, 1971. Specific reference is as follows: 144A pH, p. 276.

(2) Frozen - no sample obtained.

TABLE 11 - ANALYTICAL RESULTS OF SURFACE WATER SAMPLES
STEPAN CHEMICAL COMPANY
WILMINGTON, MASSACHUSETTS

Ammonia (1) ?

mg/ℓ as NH_4Cl

Surface Sampling Station No.	1977 Dec 8	1978 Jan 19	1978 Feb 19	1978 Mar 15	1978 Apr 10
SS-1	1.8	1.5	1.8	0.5	7
SS-2	3.0	1.5	2.8	-	-
SS-3	27	16	18	95	9
SS-4	63	25	(2)	25	36
SS-5	560	1040	(2)	520	425
SS-6	430	440	800	350	285
SS-7	340	380	780	380	270
SS-8	600	(2)	(2)	520	490
SS-9	(2)	(2)	(2)	(2)	1050
SS-10	6.0	34	110	150	10
SS-11	460	160	380	290	180
SS-12	800	1200	1700	900	550
SS-13	-	(2)	(2)	(2)	100
SS-14	-	(2)	(2)	(2)	630
SS-15	-	(2)	(2)	3	3
SS-16	-	-	-	30	40
SS-17	-	-	-	43	-

Notes:

(1) This analysis was carried out using the method described in *Standard Methods for the Examination of Water and Wastewater*, 13 ed., Am. Public Health Assoc., Washington, DC, 1971. Specific reference is as follows: 132C Phenate Method, p. 232.

(2) Frozen - no sample obtained.

TABLE 12 - ANALYTICAL RESULTS OF SURFACE WATER SAMPLES
STEPAN CHEMICAL COMPANY
WILMINGTON, MASSACHUSETTS

Dissolved Solids[1]

mg/ℓ as $CaCO_3$

Surface Sampling Station No.	Dec 8 (1977)	Jan 19 (1978)	Feb 21 (1978)	Mar 15 (1978)	Apr 10 (1978)
SS-1	114	106	94	81	130
SS-2	120	101	81	-	-
SS-3	150	125	112	82	144
SS-4	218	165	(2)	116	231
SS-5	999	945	(2)	770	775
SS-6	563	538	775	597	450
SS-7	512	515	775	605	405
SS-8	1178	(2)	(2)	927	892
SS-9	(2)	(2)	(2)	(2)	1581
SS-10	124	152	122	238	141
SS-11	240	302	285	328	310
SS-12	1922	1160	2327	1035	749
SS-13	-	(2)	(2)	(2)	481
SS-14	-	(2)	(2)	(2)	1106
SS-15'	-	(2)	(2)	47	41
SS-16	-	-	-	136	218
SS-17	-	-	-	86	-

Notes:

(1) This analysis was carried out using the method described in *Standard Methods for the Examination of Water and Wastewater*, 13 ed., Am. Public Health Assoc., Washington, DC, 1971. Specific reference is as follows: 226 Specific Conductance, p. 550. Specific conductance was converted to mg/ℓ as $CaCO_3$ using a conversion table in *Hach Methods Manual*, 8 ed., Hach Chemical Company, Ames, Iowa, 1972.

(2) Frozen - no sample obtained.

TABLE 13 - AVERAGE ANALYTICAL RESULTS OF GROUNDWATER SAMPLES FOR SAMPLING PERIOD NOV. 11, 1977 TO APRIL 10, 1978[1]
STEPAN CHEMICAL COMPANY
WILMINGTON, MASSACHUSETTS

Groundwater Well No.	pH	Acidity mg/ℓ as $CaCO_3$	Sulfate mg/ℓ as SO_4^{-2}	Chloride mg/ℓ as Cl^-	Ammonia mg/ℓ as NH_4Cl	Dissolved Solids mg/ℓ as $CaCO_3$
GW-1	6.1	106	109	386	17	356
GW-2	6.0	354	14	236	179	299
GW-3	4.4	332	616	721	240	565
GW-4	4.3	414	515	1035	582	1020
GW-5	6.0	223	683	700	232	850
GW-6	8.0	572	5000	3675	17160	5692
GW-7	4.0	1922	7150	5100	5010	7375
GW-8	5.8	369	1725	880	1310	1807
GW-10	4.3	70	7	33	1	44
GW-11	7.9	1252	4730	4975	17370	6854
GW-12	5.5	32	14	77	1	40
W-101[2]	3.4	6928	15000	3500	3700	7700

Notes: (1) Refer to Note (1) of Tables 1 through 6 for methods of analysis.
(2) W-101 sampled on May 31, 1978 only.

TABLE 14 - ANALYTICAL RESULTS
OF LAGOON WATER

Sample	pH	Acidity mg/ℓ as $CaCO_3$	Sulfate mg/ℓ as SO_4^{-2}	Chloride mg/ℓ as Cl^-	Ammonia mg/ℓ as NH_4Cl	Dissolved Solids mg/ℓ as $CaCO_3$
Water from Lagoon 2-Taken May 31, 1978	1.4	7217	15600	4750	4700	11000

Note: Refer to Note (1) of Tables 1 through 6 for methods of analysis.

TABLE 18 - GROUNDWATER ELEVATIONS[1]
STEPAN CHEMICAL COMPANY
WILMINGTON, MASSACHUSETTS

Groundwater Well No.	Elevation of Top of Protective Casing (ft)	Elevation of Ground Surface (ft)	Groundwater Elevation, (ft)								
			1977		1978					Average of All Readings	
			Nov 2	Dec 8, 9	Feb 22	Mar 15	Apr 5	Apr 10	May 31		
GW-1	89.4	87.8	79.9	78.0	79.1	78.5	82.0[4]	78.7	78.5	78.8	9
GW-2	89.7	87.6	79.7	79.7	80.6	79.9	80.2	80.5	79.9	80.1	7.5
GW-3	88.1	85.4	80.5	81.1	81.2	81.1	82.0	81.5	81.9	81.3	4.1
GW-4	82.3	79.8	76.8	77.1	77.8	77.8	77.3	77.2	77.0	77.3	2.[illegible]
GW-5	79.4[2]	76.3	76.4	76.9	Frozen	Frozen	77.3	77.1	76.7	76.9	[illegible]
GW-6	88.9	87.2	82.6	83.1	83.5	83.0	83.8	83.5	83.0	83.2	4.0
GW-7	84.8	82.7	79.5	79.8	80.5	80.5	80.2	79.9	79.5	80.0	2.7
GW-8	80.4	77.8	75.9	76.2	76.7	76.4	76.3	76.2	75.6	76.2	1.6
GW-10	89.6	87.1	81.1	81.3	82.1	81.6	82.1	81.8	81.4	81.6	5.5
GW-11	87.4	85.6	81.1	81.3	82.1	81.6	81.5	82.4	81.3	81.6	[illegible]
GW-12	85.6[3]	82.0	80.9	81.9	82.7	82.2	82.0	82.0	81.9	82.0	[illegible]
W-101	89.7	89.3	-	-	-	-	-	-	82.0	82.0	

Notes:
1) Elevation datum is USGS Mean Sea Level.
2) Prior to May 31, 1978, the top of casing was at El 79.7 ft. The casing was removed to perform a permeability test and replaced to El 79.4 ft.
3) Prior to May 31, 1978, the top of casing was at El 85.3 ft. The casing was removed to perform a permeability test and replaced to El 85.6 ft.
4) This reading is unusally high because of repairs to a nearby sewer line. This reading was not used to compute the average groundwater elevation in GW-1.

REFERENCE 4

FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES

FIT PROJECT

TDD # F1-8005-01F

December 5, 1980

TASK REPORT TO THE ENVIRONMENTAL PROTECTION AGENCY CONTRACT NO. 68-01-6056

SITE INSPECTION REPORT
of
OLIN CHEMICALS GROUP PLANT

Eames Street
Wilmington, Massachusetts

Submitted to:
John Hackler, Chief
Office of Uncontrolled Waste Sites
U.S. EPA, Region I

Submitted by:
David Cook, Project Leader
Ecology and Environment, Inc. (E & E)
FIT Team, Region I

ecology and environment, inc.

International Specialists in the Environmental Sciences

3. Background:

3.1 Description -continued

At the time when the aerial photograph presented in Figure 3 was taken (April 24, 1971), three acid pits existed to the south of the processing facilities. These pits have been replaced by rectangular settling basins as shown in Figure 4 (photographed on April 29, 1977). An extensive area of distressed vegetation is present in the east-central portion of the property. Also on the property are eleven large storage tanks noted in Figure 4. there are twelve wells on the property as noted in Figure 2.

3.2 Primary Site Activity:

Several chemicals have been synthesized on-site from a variety of ingredients. The processes used and the final products are as follows (quantities based on 1973 production figures):

Opex Process -	Dinitropentamethylenetetramine (DNPT), a slightly water soluble solid used as a blowing agent in the production of expanded rubber compounds, 1.2 million pounds per year.
Kempore Process -	Azodicarbonamide (Kempore), also a slightly water soluble solid used as a rubber blowing agent, 1.6 to 1.8 million pounds per year.
Wytox Process -	Wytox, a liquid phosphite rubber stabilizer, one million pounds per year.
Wytox ADP-X Process -	Dioctyldiphenylamine (DODPA), a dark colored resinous solid, 600,000 pounds per year.
O.B.S.H. Process -	Oxybisbenzenesulfonylhydrazide (OBSH), a rubber blowing agent, 300,000 pounds per year.

3. Background:

3.2 Primary Site Activity - continued

Raw materials and waste products for the preceding processes are listed in Table 1. Only those waste products discharged into the yard or floor drainage system are listed. The drainage system is shown in Figure 5.

In addition to the above processes, numerous coatings for rubber products were produced on site. The following chemicals were used to produce the coatings:

Bentone
Santocel
Ufamite MM 67
Toluene
Butylacetate
Acrylic Resins
Maleic Anhydride
Glycerine
Fatty Amines
Silicone
Monoethanolamine
Mineral Oil

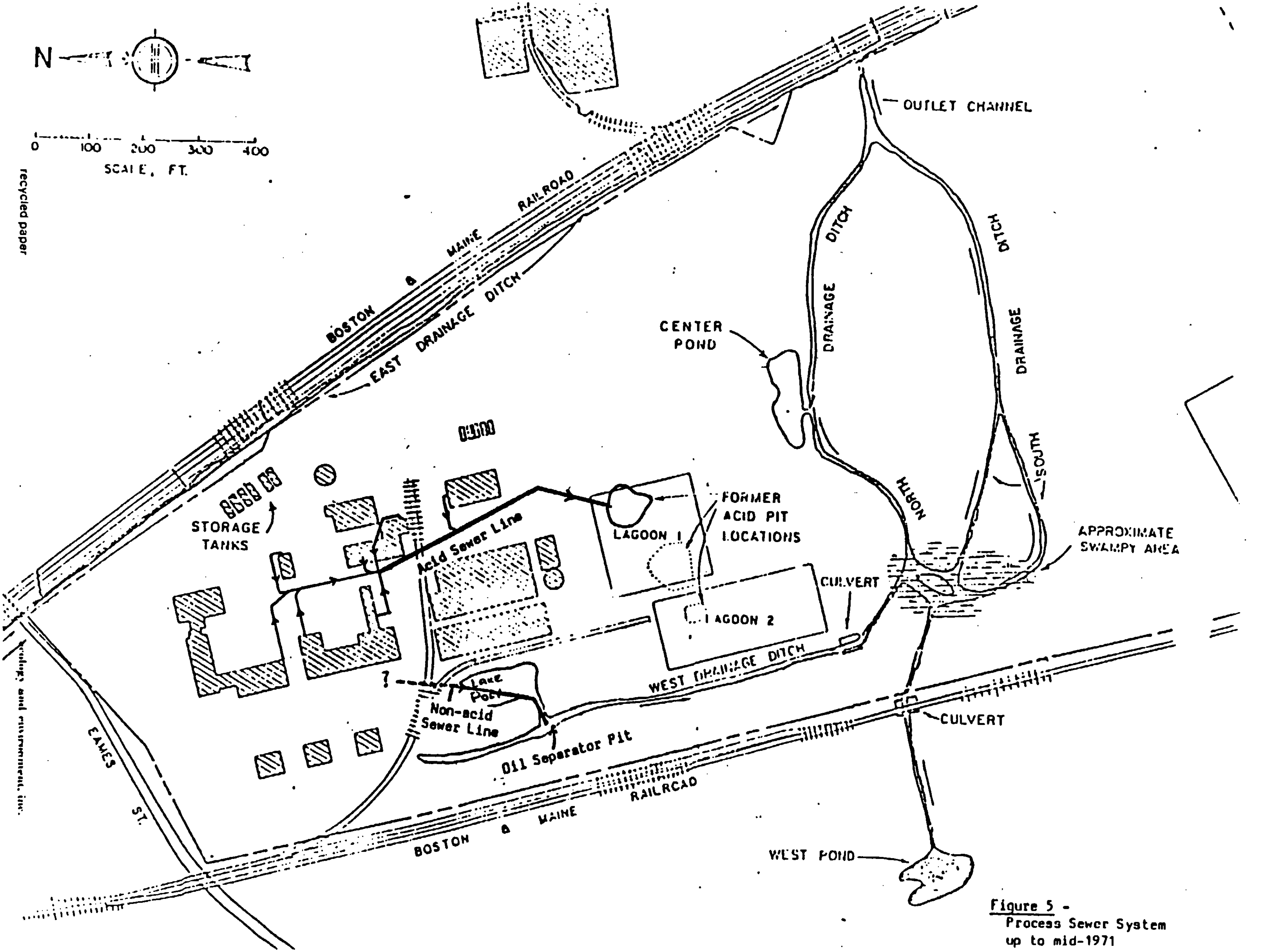

Figure 5 - Process Sewer System up to mid-1971

3. Background:

3.2 Primary Site Activity - continued

TABLE 1 - Raw Materials and Waste Products Associated With Chemical Processes Used by National Polychemicals, Inc. and Stepan Chemical Company between 1953 and 1978.

Process	Raw Materials	Waste Products
Opex	anhydrous ammonia formaldehyde sodium nitrite hydrochloric acid	sodium chloride formaldehyde sodium nitrite process oil
Kempore	liquid chlorine urea sodium hydroxide sulfuric acid hydrazine	sodium sulfate sodium chloride ammonium sulfate urea sulfuric acid
Wytox	phosphorous trichloride paraformaldehyde nonyl phenol	None sewered
Wytox ADP-X	diphenylamine diisobutylene aluminum chloride	diisobutylene aluminum hydroxide sodium chloride
O.B.S.H.	diphenyloxide chlorosulfonic acid	sulfuric acid

3. Background:

3.2 Primary Site Activity - continued

According to MDC records, the following materials were being stored on-site as of June 30, 1980:

MATERIAL BEING STORED:	Annual Thruput (gals.)	Type of Storage Container (tank, drum, etc.)	Size of Container (gals.)
1. Formaldehyde	172,500	Tank	13,300
2. Nonyl phenol	281,600	Tank	10,000
3. Dinonyl phenol	30,500	Tank	6,700
4. Ethyl hexoic acid	18,400	Tank	5,000
5. Dioctylphthlate	54,200	Tank	15,000
6. Process Oil	11,800	Tank	4,250
7. TNPP (Wytox 312)	50,000	Tank	10,000

Chemicals used or manufactured at this site are transported in 55-gallon drums by railcar.

3.3 Secondary site activity:

Not applicable

3. Background:

3.4 Hazards Identified or Alleged - continued

Water	27,500 lbs.
Gypsum	26,800 lbs.
$CaCO_3$	650 lbs.
Calcium Oxbisbenzene Sulfonate	Trace
Na_2SO_4	Trace
$Al\ (OH)_3$	Trace
$NaCl$	Trace
$CaCl_2$	Trace
Formaldehyde	Trace
$NaNO_2$	Trace
NH_4Cl	Trace
TOTAL	54,950 lbs. = 27.5 Tons/Day

A study performed in 1979 by Geotechnical Engineers, Inc. of Winchester, Massachusetts, indicated that several holes exist in the PVC liner (See Figures 6 to 8). It was also discovered that sludge has been dumped in an emergency lagoon when the two existing lagoons filled to capacity (See Figure 4). This emergency lagoon had no liner and was formed by dredging soil to form a roughly rectangular area. Solids from the lagoons are dredged periodically and landfilled on the southwest corner of the property. The landfill site was approved by the State Department of Environmental Quality Engineering (DEQE). The analysis of the sludge indicates that no environmental hazards would result from leaching of the lagooned or landfilled materials into the ground.

Non-sulfate bearing wastes generated on-site are presently discharged into an underground sewer line which connects to a Town of Wilmington owned sewer. This line connects to a Metropolitan District Commission (MDC) sewer line. Complaints regarding high chloride, sulfate and ammonia levels in the sewer effluent have been made on several occasions.

3. Background:

3.4 Hazards Identified or Alleged - continued

An unofficial report from a former Stepan employee indicates that phosphorus trichloride was often dumped directly into the ground and that residues were buried next to the wetlands near the drainage channel. Sediment and ground water samples were taken in an attempt to confirm or deny the existence of an environmental hazard resulting from such alleged activities.

A 1977 aerial photograph shows two areas where drums were stored on-site (See Figure 4). Leaks in these drums may have resulted in ground water contamination. The 1971 photo (Figure 3) also reveals a spill generating from the group of six large storage tanks on the east side of the property. Since 1973, "black ooze" has been noted seeping into the drainage ditch paralleling the railroad tracks east of the site (Figure 9). A sample was taken by the E & E, FIT team on October 2, 1980, (See memo to John Hackler from David Cook dated October 6, 1980). A conversation between D. Cook (E & E) and D. Vaughn (Olin) revealed that dioctylphthalate, dimethylamine, dioctylamine and other related compounds are present in the "black ooze" as well as in Well GW-2 (See Figure 2). This was determined by an analysis performed by Olin. Mr. Vaughn was very hesitant to have Well GW-2 sampled. He stated that he knew the well was contaminated and Olin was prepared to perform remedial actions of an undisclosed nature to rectify the situation.

The drainage ditch mentioned above has been the object of sampling and analysis on several occasions. On January 23, 1980, five samples were collected by the EPA and subsequently analyzed for purgeable organics. The results indicated the following:

1. Moderate to high levels of 1,1 - dichloroethane, 1,1,1 - trichloroethane, trichloroethylene, toluene and xylene are present upstream of Stepan/Olin.

3. Background:

3.4 Hazards Identified or Alleged - continued

2. Moderate to high levels of 1,1,2 - dichloroethylene and 1,1,2 - trichloroethane in addition to the five chemicals listed under (1) are present downstream of Stepan/Olin.

3. Therefore, some chlorinated hydrocarbons may be leaching from Stepan/Olin into the drainage ditch.

4. Analyses of the outfalls from Stepan/Olin do not indicate significant off-site migration of contamination.

Priority pollutant samples were taken from the drainage ditch paralleling the railroad tracks on July 28, 1980. Analyses of samples taken upstream and downstream of the Stepan/Olin property suggested that small amounts of the priority pollutants listed in Table 2 are generating from the site.

The primary purpose of this site inspection was to gather appropriate samples for analysis to determine if any ground or surface water contamination is generating from Olin property. The sampling plan is presented in Section 4, and the sampling procedures and screening results are included in Section 7.2 of this report. The preliminary results indicate that, with the exception of the "black ooze" and significant amounts of residual heavy hydrocarbons noted in Section 7.2, no significant sources of contamination are present on site. Evidence of buried drums was noted just west of the headwall (See Figure 2). However soil, surface water and groundwater revealed no evidence of hazardous chemicals generating from the burial site.

4. Concept of Operation:

A seven-person team entered this site to identify the nature of materials stored on site, investigate possible sources of contamination and collect appropriate samples for screening and analysis.

Table 2:

Priority Pollutants Suggested To Be Entering the East Drainage Ditch from Olin Property
(Based on July 28, 1980 Priority Pollutant analyses)

CONTAMINANT	METHOD OF CONTACT	HEALTH EFFECTS
Trichloroethylene	Inhalation:	Headache, nausea, drowsiness
	Chronic Inhalation:	Possibly liver damage. (This has not been documented in Humans).
	Inhalation of large quantities:	May cause narcosis
	Ingestion:	Possibly liver damage. (This has not been documented in humans).

Note: TCE is an experimental animal carcinogen. (rats). 1979 recommended ambient water quality criterion 2ug/l Based on tumors in rats and not on human health affects.

N-Nitrosodiphenylamine	Ingestion only	Not an inhalation hazard.
	Toxicity:	This compound belongs to the class of nitrosamines.

Note: Nitrosamines are suspected human carcinogens. There are no human data, but nitrosamines do cause tumors of the stomach, lung, liver, bladder and kidney in rats. The class criterion is 0.1/ug/l water (ambient water) based on tumor formation in rats.

Bis (2-Ethyl hexyl) phthalate

Note: Phthalates are non-biodegradable and potential aquatic hazards. They have no documented human health effects that may be associated with environmental hazards.

Phthalates are used as plasticizers in latex materials and are often used in medical equipment such as IV infusion sets.

Phthalates may leach off of such equipment and are suspected in the etiology of shock lung syndrome when injected intraveneously.

1,1,2 - Trichloroethane	Toxicity - Inhalation:	Narcotic, local irritant may (B - cause liver and kidney damage.
	Ingestion:	Local irritant (in 1 ug/l concentrations) suspected to cause liver and kidney damage

Note: It may be a percutaneous hazard - when hands are immersed in concentrated liquid (only).

1,2 - trans-Dichloroethylene	Toxicity:	low toxicity except when exposed to concentrated vapor - nausea, vomiting, dizziness with immediate recovery upon removal from exposure.
	Ingestion:	Ingestion of concentrated liquid - hausea, vomiting.

Note: 1,2 - DCE is a dermatitis producing agent. It is not percutaneous.

Vinyl Chloride:

Note: A well-known human carcinogen. 1979 ambient WQ criterian = 51 ug /l based on tumor-production in rats

TABLE 3 - Parameters for Monitoring Wells on the Olin Property in Wilmington, Massachusetts

Well #	Depth of Well (ft.)	Water Table Depth (ft.)	Depth of Screened Section (ft.)
GW - 1	21.2	9.0	14.0 - 19.5
GW - 2	15.0	7.5	9.5 - 14.5
GW - 3	22.0	4.2	10.0 - 15.0
GW - 4	13.5	2.5	8.0 - 13.0
GW - 5	12.0	0	5.0 - 10.0
GW - 6	18.0	4.0	8.2 - 13.2
GW - 7	14.0	2.6	8.5 - 13.5
GW - 8	10.2	1.5	3.2 - 8.2
GW -10	24.0	5.4	4.8 - 9.8
GW -11	17.0	3.9	9.0 - 14.0
GW -12	12.7	0	4.8 - 9.8

- All wells have inside diameters of 1.5".
- Location of wells is shown in Figure 2 of this report.
- All well parameters are from: Report on Groundwater and Surface Water Study - Stepan Chemical Company, Wilmington, Massachusetts: Geotechnical Engineers, Inc. Winchester, Massachusetts, December 6, 1978.

6. Site Entry Team and Schedule of Events

6.2 Schedule of Events - continued

Team 1:

1615 - Teams 1 and 2 reunite at van and proceed to decon personnel and equipment. Chain of custody forms are completed and D. Vaughn of Olin signs for split samples transferred to him.

1640 - Site Inspection completed, team returns to office.

7. Results of Investigation

7.1 Site Representative Interview:

A detailed interview regarding the processes used on site was not necessary as this information was gathered during the preliminary assessment and is incorporated into Section 3.2 of this report. Mr. David Vaughn, Environmental Coordinator for Olin Chemicals Group, did confirm the presence of dioctylphthalate, diphenolamine, dioctylamine and other related chemicals in the "black ooze" seeping into the East Drainage Ditch. The seepage appears to be the result of a spill generating from the tank farm which took place during or prior to 1973. Presented in Appendix C is a letter from Charles P. Riley, Jr., General Manager of National Polychemicals to Thomas C. McMahon, Director of Massachusetts Water Resources Commission, dated July 18, 1973, describing the presence of "black ooze". Mr. Vaughn also confirmed the presence of contamination in Well GW-2 related to this spill and was hesitant to have us sample this well prior to undisclosed remedial action planned by Olin.

Mr. Vaughn expressed his desire to obtain duplicate samples and photographs associated with the site inspection.

REFERENCE 5

(5)

Olin CHEMICALS GROUP

51 EAMES STREET, WILMINGTON, MA 01887

June 10, 1986

Mr. Peter Dore
Commonwealth of Massachusetts
Division of Water Pollution Control
One Winter Street
Boston, MA 02108

Dear Mr. Dore:

Please find attached the results from Olin's plant-wide groundwater studies conducted in May and December 1985. In May 1985, wells were sampled throughout the site on a one-time basis for total and hexavalent chromium and groundwater table measurements were taken. Total chromium occurrence remains highest at Well GW-22D, as previous reports have indicated. Hexavalent chromium levels are either below the detection limit or just above. Groundwater movement is generally to the east-southeast (see Figure 1). Based on these results and the direction of groundwater flow, ten (10) wells were selected to continue the chromium groundwater study in December 1985. From these results, it does not appear that there is any significant movement of chromium to the east-southeast.

A hydrogeological study performed for Olin by Malcolm Pirnie, Inc. (Hydrogeologic Investigation, February, 1982) indicated the presence of a bedrock trough dipping from the east to the west in the vicinity of GW-22D. In order to evaluate if this trough is serving as a conduit for groundwater flow to the west and to provide additional monitoring of groundwater flow to east-southeast, twelve (12) new wells are planned for installation this summer (See Figure 2). Eight (8) will be along the western border of the property and four (4) will be to the east-southeast of GW-22D. Three (3) additional surface stations will also be added to the sampling program in 1986. These additional wells and surface stations will help determine if there is groundwater movement to the west and whether it is the source of the total chromium appearing at surface stations 5 and 12. Additional details relating to sampling for 1985 and 1986 are provided below:

Initial analytical results for the May 1985 samplings indicated that the total chromium level in Well GW-22D was less than 0.005 mg/l (BDL). This result was questioned by Olin as this well has been reporting higher levels of total chromium. Upon rerunning and rechecking the analytical results, the outside laboratory indicated that a level of 170 mg/l of total chromium by EPA Method 218.1 was the more precise measurement and that there was a strong negative bias in utilizing EPA Method 218.3 for total chromium measurements. As indicated in our previous correspondence, there has been some question as to which method (218.1 vs. 218.3) was the best method to determine total chromium due to the level of dissolved solids in the groundwater. To resolve this matter, samples taken in December 1985 were analyzed by our contract laboratory using EPA Method 218.1 as well as sent to another outside laboratory for analysis by inductively coupled plasma EPA Method 200.7. Results between both laboratories in December 1985 showed very good correlation and verify that Method 218.1 is the appropriate method for analyzing for total chromium at Wilmington.

The next round of sampling is scheduled for June 1986. The ten (10) wells sampled in December 1985 along with the three (3) additional surface stations will be sampled. The twelve (12) new wells to be installed may not be in place at this time. However, as soon as the wells are installed and developed, they will be sampled. All groundwater and surface stations will be analyzed for chlorides, sulfates, ammonia, pH, specific conductance, total chromium (EPA Method 218.1) and hexavalent chromium (EPA Method 218.4).

As always, we look forward to and welcome any comments you may have on our continuing groundwater monitoring program. We will be contacting you shortly to discuss this program as well as the interceptor well system's future operation.

Yours truly,

OLIN CORPORATION

Ronald J. McBrien

Ronald J. McBrien
Plant Manager

RJM/JWO/vrp

OLIN CORPORATION
SURFACE WATER DATA
DECEMBER, 1985

Point No.	Cl (mg/l)	SO_4 (mg/l)	NH_3 (mg/l)	pH	Specific Conductance (µmhos/cm)	Chromium [1] Total (mg/l)	Chromium [2] Total (mg/l)	Chromium [3] Hexavalent (mg/l)
SS-5	230	820	190	5.8	2600	2.5	2.3	<0.005
SS-12	320	1000	240	5.2	5100	0.52	0.53	<0.005
SS-16	110	210	44	5.5	960	0.29	0.30	<0.005

1. Total chromium, direct aspiration - EPA Method 218.1
2. Total chromium, inductively coupled plasma - EPA Method 200.7
3. Hexavalent chromium, chelation-extraction - EPA Method 218.4

JWO/vrp
53/JW08
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OLIN CORPORATION
GROUNDWATER DATA
DECEMBER, 1985

Well No.	Water Elevation (Ft MSL)	Cl (mg/l)	SO_4 (mg/l)	NH_3 (mg/l)	Specific Cond. (µmhos/cm)	pH	Chromium[1] Total (mg/l)	Chromium[2] Total (mg/l)	Chromium[3] Hexavalent (mg/l)
GW-4	Not accessible	--	--	--	--	--	--	--	--
GW-10	80.9	4.2	15	<1	165	3.9	0.006	<0.05	<0.005
GW-17S	78.6 (would not recover)	--	--	--	--	--	--	--	--
GW-17D	78.6	340	6000	340	5125	5.1	2.1	2.2	0.020
GW-18S	Dry	--	--	--	--	--	--	--	--
GW-18D	74.2 (would not recover)	--	--	--	--	--	--	--	--
GW-19S	81.0	18	1000	22	3850	5.9	0.012	<0.05	<0.005
GW-19D	80.9	160	680	170	3425	6.1	0.052	0.07	<0.005
GW-22S	81.7	200	1100	150	4100	7.2	0.045	0.07	<0.005
GW-22D	80.4	16000	53000	6400	28000	3.9	1200	1300	<0.005

1. Total chromium, direct aspiration - EPA Method 218.1
2. Total chromium, inductively coupled plasma - EPA Method 200.7
3. Hexavalent chromium, chelation-extraction - EPA Method 218.4

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[illegible] [illegible]-08
5/[illegible]/86

OLIN CORPORATION
SURFACE WATER DATA
MAY, 1985

Point No.	Specific Conductance (µmhos/cm)	pH	Chromium [1] Total (mg/l)	Chromium [2] Hexavalent (mg/l)
SS-1	375		0.19	<0.005
SS-2	550		<0.005	<0.005
SS-5	350		1.1	<0.005
SS-11	550		0.12	<0.005
SS-12	3100		15	<0.005
SS-16	625		0.063	<0.005

JWO 'vrp
53/..408
5/2..'86

OLIN CORPORATION
GROUNDWATER DATA
MAY, 1985

Well No.	Water Elevation (Ft MSL)	Cl (mg/l)	SO_4 (mg/l)	NH_3 (mg/l)	Specific Cond. (µmhos/cm)	Chromium[1] Total (mg/l)	Chromium[2] Hexavalent (mg/l)
GW-1	76.9	--	--	--	380	< 0.005	< 0.005
GW-3	79.9	--	--	--	350	< 0.005	< 0.005
GW-4	73.0	--	--	--	1625	0.088	< 0.005
GW-5	76.0	--	--	--	450	< 0.005	< 0.005
GW-6	81.2	--	--	--	3000	< 0.005	< 0.005
GW-7	79.9	2700	27000	*	18500	12	< 0.005
GW-8	78.6	480	1900	*	4250	< 0.005	< 0.005
GW-10	80.7	--	--	--	95	0.55	< 0.005
GW-11	79.9	--	--	--	4700	0.44	< 0.005
GW-12	81.4	--	--	--	325	0.069	< 0.005
GW-13	77.8	--	--	--	220	< 0.005	< 0.005
GW-14	78.2	--	--	--	840	< 0.005	< 0.005
GW-15	80.3	620	250	*	6300	0.74	< 0.005
GW-16	86.6	--	--	--	835	0.12	< 0.005
GW-17S	78.8	--	--	--	1425	0.10	< 0.005
GW-17D	78.2	440	2700	*	5400	4.0	0.050
GW-18D	76.2	--	--	--	375	< 0.005	< 0.005
GW-19S	81.2	--	--	--	3200	0.37	< 0.005
GW-19D	80.7	--	--	--	3200	< 0.005	< 0.005
GW-20	78.5	--	--	--	62	0.054	< 0.005
GW-21	83.0	180	29	*	725	0.038	< 0.005
GW-22S	81.2	--	--	--	4400	0.22	< 0.005
GW-22D	80.9	17000	59000	*	20000+	< 0.005/170[3]	< 0.005
GW-25	80.4	--	--	--	6400	0.49	< 0.005

1. Total chromium, chelation-extraction - EPA Method 218.3
2. Hexavalent chromium, chelation-extraction - EPA Method 218.4
3. Total chromium, direct aspiration - EPA Method 218.1

* Contract laboratory obtained conflicting values and matrix interferences while attempting to analyze these samples for ammonia. Laboratory could not quantify level of ammonia but concluded that all samples except GW-21 had significantly greater than 100 mg/l of ammonia.

WILMINGTON

Average Levels, by Year

SO_4 (mg/l)

Well	1981-82	1983	1984	Trend
GW-1	54.5	18.5	22.0	Same
GW-2A	872.2	255.0	140.0	Dec.
GW-4	1,205.9	560.0	655.0	Dec.
GW-5	1,618.5	655.0	740.0	Dec.
GW-6	17,766.5	1,790.0	1,700.0	Same
GW-7	16,055.5	4,060.0	5,900.0	Dec.
GW-8	2,057.5	2,745.0	1,295.0	Dec.
GW-10	244.5	39.5	18.0	Dec.
Gw-11	3,110.1	1,740.0	755.0	Dec.
GW-13	151.8	8.0	18.5	Dec.
GW-15	336.2	814.0	665.0	Inc.
GW-17D	3,345.4	2,940.0	2,500.0	Same
GW-19S	1,760.7	86.0	980.0	Same
GW-19D	2,409.8	985.0	700.0	Dec.
GW-22S	2,828.3	927.5	1,050.0	Dec.
GW-22D	31,751.3	4,270.0	50,000.0	Same
GW-25	4,860.0	1,755.0	1,035.0	Dec.

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61/MJB1

WILMINGTON

Average Levels, by Year

NH_3-N (mg/l)

Well	1981-82	1983	1984	Trend
GW-1	6.4	5.5	1.4	Same
GW-2A	158.6	120.5	52.0	Dec.
GW-4	153.9	180.0	83.0	Dec.
GW-5	139.2	77.0	65.5	Dec.
GW-6	2,710.7	230.0	29.6	Dec.
GW-7	2,192.0	2,200.0	850.0	Dec.
GW-8	297.7	500.0	170.0	Same
GW-10	78.9	57.5	1.0	Dec.
GW-11	1,403.1	700.0	265.0	Dec.
GW-13	33.1	2.4	0.4	Dec.
GW-15	280.8	660.0	650.0	Inc.
GW-17D	317.0	485.0	210.0	Same
GW-19S	101.7	64.0	26.0	Dec.
GW-19D	591.2	310.0	122.5	Dec.
GW-22S	524.7	22.0	15.9	Dec.
GW-22D	2,810.7	2,450.0	2,250.0	Same
GW-25	1,246.0	3,550.0	390.0	Dec.

MJB/wsr
61/MJB1

OLIN CORPORATION
SURFACE WATER DATA
December, 1984

Point No.	Surface Water Flow (CFS)	Cl mg/l	SO_4 mg/l	NH_3 mg/l	Specific Conductance µmhos/cm	pH	Cr^{+3}(1) mg/l	Cr^{+3}(2) mg/l	Dioctyl Phthatate mg/l	N-Nitroso-diphenylamine mg/l
SS-1	0.13*	41	20	0.49	0.318	5.7	--	--	<5	<5
SS-2	<0.1*	--	--	---	-----	---	--	--	--	--
SS-5	0.14*	180	420	88	≅2,000	6.4	<0.050	<0.064	<5	<5
SS-11	<0.1*	--	--	---	-----	---	--	--	--	--
SS-12	<0.1*	230	690	110	2,800	5.0	--	--	--	--
SS-16	---	56	45	0.16	0.480	5.76	--	--	<5	<5

* Flow was too low to be measured with the flow meter
Values are estimates based on observation.

JWO/wsr
27/JW06
5/8/85

GROUNDWATER DATA
OLIN CORPORATION
December, 1984

Well No.	Water Elevation (Ft. MSL)	Cl mg/l	SO_4 mg/l	NH_3 mg/l	Specific Conductance µmhos/cm	pH	Cr^{+3}(1) mg/l	Cr^{+3}(2) mg/l
GW-1	77.2	190	22	1.6	920	6.35	----	----
GW-2A	78.4	---	---	---	-----	----	----	----
GW-3	79.9	---	---	---	-----	----	----	----
GW-4	76.2	190	540	66	2,300	5.15	----	----
GW-5	76.2	130	280	34	1,400	6.00	----	----
GW-6	80.7	95	1,200	53	3,200	5.50	----	----
GW-7	79.9	2,700	9,600	660	10,000+	4.60	19	13
GW-8	78.7	730	1,700	160	6,100	4.40	----	----
GW-10	80.6	4.0	<20	0.39	120	4.65	----	----
GW-11	79.8	180	630	150	3,000	8.30	<0.050	<0.050
GW-12	80.9	---	---	---	-----	----	----	----
GW-13	77.7	22	20	0.31	180	5.50	----	----
GW-14	78.1	----	---	----	-----	----	----	----
GW-15	79.8	2,100	450	600	10,000+	8.55	----	----
GW-16	80.1	----	---	----	-----	----	----	----
GW-17S	79.7	----	---	----	-----	----	----	----
GW17D	78.4	500	2,500	210	6,900	5.15	----	----
GW-18S	Dry	----	---	----	-----	----	----	----
GW-18D	75.7	----	---	----	-----	----	----	----
GW-19S	81.3	1,300	860	30	2,800	6.70	----	----
GW-19D	80.6	89	430	85	1,800	6.15	----	----
GW-20	77.6	----	---	----	-----	----	----	----
GW-21	82.9	----	---	----	-----	----	----	----
GW-22S	81.1	150	1,000	22	3,400	7.05	----	----
GW-22D	80.7	12,000	42,000	2,000	-----	4.50	1099.9	699.9
GW-23	77.8	----	---	----	-----	----	----	----
GW-25	80.2	360	1,200	370	5,600	8.75	----	----

(1) Total chromium, unextracted - Hexavalent chromium (Cr^{+6}), extracted (EPA Methods 218.1-218.4)
(2) Total chromium, extracted - Hexavalent chromium, extracted (EPA Methods 218.3-218.4)

OLIN CORPORATION
SURFACE WATER DATA
July, 1984

nt No.	Surface Water Flow (CFS)	Cl mg/l	SO_4 mg/l	NH_3 mg/l	Specific Conductance µmhos/cm	pH	Cr^{+3} mg/l	Dioctyl[1] Phthatate mg/l	N-Nitroso-[2] diphenylamine mg/l
-1	0.160	67	24	<0.05	316	6.3	--	0.002	0.004
-2	0.250	--	--	--	--	--	--	--	--
-5	0.0579	420	1200	34	3280	6.8	--	<0.001	0.004
-11	0.0039	--	--	--	--	--	--	--	--
-12	0.0875	420	950	67	3300	6.3	--	--	--
-16	--	89	52	7.3	510	6.7	--	<0.001	0.013

Dioctyl Phthalate
N-Nitrosodiphenylamine

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/JW06
/15/84

GROUNDWATER DATA
OLIN CORPORATION
JULY, 1984

Well No.	Water Elevation (Ft. MSL)	Cl mg/l	SO_4 mg/l	NH_3 mg/l	Specific Conductance µmhos/cm	pH	Cr^{+3} mg/l	Dioctyl Phthatate mg/l	N-Nitroso-diphenylamine mg/l
GW-1	77.1	220	22	1.2	650	6.6	----	----	----
GW-2A	---	220	140	52	1810	9.2	----	<0.001	0.46
GW-3	79.5	---	---	---	-----	----	----	----	----
GW-4	79.5	340	770	100	2400	6.8	----	----	----
GW-5	76.0	450	1200	97	295	6.6	----	----	----
GW-6	81.3	200	2200	6.1	2590	6.2	----	----	----
GW-7	79.9	18,000	2200	1040	28,200	4.6	39	----	----
GW-8	78.3	610	890	180	4560	5.1	----	----	----
GW-10	80.8	11	26	1.7	118	6.7	----	----	----
GW-11	79.8	470	880	380	4740	9.1	0.09	----	----
GW-12	81.0	----	----	----	----	----	----	----	----
GW-13	78.3	30	17	<0.5	145	5.8	----	----	----
GW-14	78.7	----	----	----	----	----	----	----	----
GW-15	80.7	3100	880	700	11,800	8.5	----	----	----
GW-16	80.9	----	----	----	----	----	----	----	----
GW-17S	79.7	----	----	----	----	----	----	----	----
GW17D	----	NO SAMPLE COLLECTED - PADLOCK JAMMED							
GW-18S	Dry	----	----	----	----	----	----	----	----
GW-18D	75.8	----	----	----	----	----	----	----	----
GW-19S	81.2	7.0	1100	22	2250	6.7	----	----	----
GW-19D	81.2	350	970	160	2910	6.9	----	----	----
GW-20	78.0	----	----	----	----	----	----	----	----
GW-21	83.1	----	----	----	----	----	----	----	----
GW-22S	81.0	7.5	1100	9.8	2600	7.3	----	----	----
GW-22D	81.1	4900	58,000	2500	62,300	4.1	1500	----	----
GW-23	78.5	----	----	----	----	----	----	----	----
GW-25	80.2	960	870	410	7660	8.3	----	----	----

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27/GW05
11/15/84

OLIN CORPORATION

SURFACE WATER DATA
OCTOBER, 1983

Point No.	Surface Water Flow (CFS)	Cl mg/l	SO_4 mg/l	NH_3 mg/l	Specific Conductance µmhos/cm	pH	Cr^{+3} mg/l	Dioctyl Phthatate mg/l	N-Nitroso-diphenylamine mg/l
SS-1	0.08125	40	20	21	230	6.0	--	0.150	<0.001
SS-2	0.2654	--	--	--	--	--	--	--	--
SS-5	0.0625	200	470	120	1900	7.2	0.06	0.014	<0.001
SS-11	0.00688	--	--	--	--	--	--	--	--
SS-12	0.0869	100	265	49	900	7.0	--	--	--
SS-16	--	72	71	10	380	6.5	--	0.010	0.030

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3/[illegible]/84

OLIN CORPORATION

GROUNDWATER DATA
OCTOBER, 1983

Well No.	Water Elev. (Ft. MSL)	Cl mg/l	SO_4 mg/l	NH_3 mg/l	Specific Conductance µmhos/cm	pH	Cr^{+3} mg/l	Dioctyl Phthatate mg/l	N-Nitroso-diphenylamine mg/l
GW-1	77.5	92	24	1.2	520	6.3	--	--	--
GW-2A	--	1180	330	160	4100	5.8	--	0.110	15
GW-3	79.0	--	--	--	--	--	--	--	--
GW-4	76.1	274	710	100	2200	5.1	--	--	--
GW-5	76.2	191	370	66	1500	6.0	--	--	--
GW-6	80.0	255	1710	240	3900	5.9	--	--	--
GW-7	79.5	3800	5130	3000	30000	4.2	65	--	--
GW-8	77.1	995	3990	610	8400	4.3	--	--	--
GW-10	80.2	51	62	39	560	5.6	--	--	--
GW-11	80.5	700	1610	680	--	8.0	<0.05	--	--
GW-12	79.3	--	--	--	--	--	--	--	--
GW-13	78.5	96	9	0.3	360	5.7	--	--	--
GW-14	78.4	--	--	--	--	--	--	--	--
GW-15	79.9	6	1340	560	4700	7.6	--	--	--
GW-16	80.2	--	--	--	--	--	--	--	--
GW-17S	78.9	--	--	--	--	--	--	--	--
GW-17D	78.6	715	3470	420	7100	4.9	--	--	--
GW-18S	78.1	--	--	--	--	--	--	--	--
GW-18D	74.6	--	--	--	--	--	--	--	--
GW-19S	80.5	32	140	66	2100	6.1	--	--	--
GW-19D	80.2	380	1680	500	5000	6.1	--	--	--
GW-20	75.5	--	--	--	--	--	--	--	--
GW-21	82.5	--	--	--	--	--	--	--	--
GW-22S	80.7	8	1100	25	2800	7.2	--	--	--
GW-22D	80.3	10000	5400	3000	49000	3.5	830	--	--
GW-23	77.9	--	--	--	--	--	--	--	--
GW-25	80.2	650	1910	520	6000	7.0	--	--	--

SURFACE WATER DATA
OLIN CORPORATION
JUNE 1983

Point No.	Surface Water Flow (CFS)	Cl mg/l	SO_4 mg/l	NH_3 mg/l	Specific Conductance µmhos/cm	pH	Cr^{+3} mg/l	Dioctyl Phthalate mg/l	N-nitroso-diphenylamine mg/l
SS-1	0.560	38	1.8	7.0	135	5.6	--	0.004	<0.001
SS-2	0.65	--	--	--	--	--	--	--	--
SS-5	0.23	44	240	85	1259	7.2	<0.05	<0.001	<0.001
SS-11	0.133	--	--	--	--	--	--	--	--
SS-12	0.143	110	610	90	710	6.6	--	--	--
SS-16	0.675	63	71	28	295	6.7	--	0.027	<0.001

GROUNDWATER DATA
OLIN CORPORATION
JUNE 1983

Well No.	Water Elevation (ft. ASL)	Cl mg/l	SO_4 mg/l	NH_3 mg/l	Specific Conductance µmhos/cm	pH	Cr^{+3} mg/l	Dioctyl Phthalate mg/l	N-nitroso-diphenylamine mg/l
GW-1	77.2	150	13	9.8	6200	6.7	--	--	--
GW-2A	--	490	180	81	1260	6.2	--	0.21	6.5
GW-3	80.3	--	--	--	--	--	--	--	--
GW-4	76.2	310	1050	260	1484	6.1	--	--	--
GW-5	75.6	310	940	86	3111	6.1	--	--	--
GW-6	82.1	89	1870	220	2300	5.9	--	--	--
GW-7	80.1	2700	2990	1400	19700	4.8	61	--	--
GW-8	77.3	560	1500	390	2750	5.3	--	--	--
GW-10	80.9	13	17	76	80	4.5	--	--	--
GW-11	81.2	840	1870	720	8000	9.2	0.11	--	--
GW-12	80.7	--	--	--	--	--	--	--	--
GW-13	78.9	19	7	4.5	45	5.8	--	--	--
GW-14	79.0	--	--	--	--	--	--	--	--
GW-15	80.5	210	289	760	2740	7.4	--	--	--
GW-16	81.4	--	--	--	--	--	--	--	--
GW-17S	79.1	--	--	--	--	--	--	--	--
GW-17D	79.3	380	2410	550	8140	5.2	--	--	--
GW-18S	77.1	--	--	--	--	--	--	--	--
GW-18D	77.4	--	--	--	--	--	--	--	--
GW-19S	81.7	57	3.2	62	2340	7.2	--	--	--
GW-19D	81.7	57	290	120	820	6.8	--	--	--
GW-20	77.7	--	--	--	--	--	--	--	--
GW-21	83.6	--	--	--	--	--	--	--	--
GW-22S	83.4	19	755	19	2190	7.2	--	--	--
GW-22D	81.4	2300	3140	1900	56000	4.2	*590	--	--
GW-23	77.7	--	--	--	--	--	--	--	--
GW-25	80.9	1700	1600	1100	17370	7.2	--	--	--

REFERENCE 6

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TABLE 4

Waste Characteristics Values

Chemical/Compound	Toxicity/ Persistence[1]	Toxicity[2]	Reactivity[2]
Acenapthene	9	3	0
Acetaldehyde	6	6	2
Acetic Acid	6	6	1
Acetone	6	6	0
2-Acetylaminoflourene	18	9	0
Aldrin	18	9	0
Ammonia	9	9	0
Aniline	12	9	0
Anthracene	15	9	0
Arsenic	18	9	0
Arsenic Acid	18	9	0
Arsenic Trioxide	18	9	0
Asbestos	15	9	0
Barium (Ba)	18	9	2
Benzene	12	9	0
Benzidine	18	9	0
Benzoapyrene	18	9	0
Benzopyrene, NOS	18	9	0
Beryllium & Compounds NOS (Be)	18	9	0
Beryllium Dust, NOS	18	9	0
Bis (2-Chloroethyl) Ether	15	9	0
Bis (2-Ethylhexyl Phthalate	12	3	0
Bromomethane	15	9	0
Cadmium (Cd)	18	9	0
Carbon Tetrachloride	18	9	0
Chlordane	18	9	0
Chlorobenzene	12	6	0
Chloroform	18	9	0
3-Chlorophenol	12	6	0
4-Chlorophenol	15	9	0
2-Chlorophenol	12	6	0
Chromium (Cr)	18	9	0
Chromium, Hexavalent (Cr^{+6})	18	9	0

Table 4 (cont.)

Chemical/Compound	Toxicity/ Persistence[1]	Toxicity[2]	Reactivity[2]
Chromium, Trivalent (Cr^{+3})	15	6	0
Copper & Compounds, NOS (Cu)	18	9	0
Creosote	15	6	0
Cresols	9	9	0
Cyanides (soluble salts), NOS	12	9	0
Cyclohexane	12	6	0
DDE	18	9	0
DDT	18	9	0
Diaminotoluene	18	6	0
1, 2-Dibromo 3 chloropropane	18	9	0
Di-N-Butyl-Phthalate	18	6	0
1, 4-Dichlorobenzene	15	6	0
Dichlorobenzene, NOS	18	6	0
1, 1-Dichloroethane	12	6	0
1, 2-Dichloroethane	12	9	1
1, 1-Dichloroethene	15	9	2
1, 2-trans-Dichloroethylene	12	3	2
Dichloroethylene, NOS	12	3	2
2, 4-Dichlorophenol	18	6	0
2, 4-Dichlorophenoxyacetic Acid	18	9	0
Dicyclopentadiene	18	9	1
Dieldrin	18	9	0
2, 4-Dinitrotoluene	15	9	3
Dioxin	18	9	0
Endosulfan	18	9	0
Endrin	18	9	0
Ethylbenzene	9	6	0
Ethylene dibromide	18	9	0
Ethylene Glycol	9	6	0
Ethyl Ether	18	6	1
Ethylmethacrylate	12	6	0
Fluorine (F)	18	9	4
Formaldehyde	9	9	0
Formic Acid	9	6	0

Table 4 (cont.)

Chemical/Compound	Toxicity/ Persistence[1]	Toxicity[2]	Reactivity[2]
Heavy Metals, NOS	18	9	0
Heptachlor	18	9	0
Hexachlorobenzene	18	6	0
Hexachlorobutadiene (C_{16})	18	9	1
Hexachlorocyclohexane, NOS	18	9	0
Hexachlorocyclopentadiene ($C_{5,6}$)	18	9	2
Hydrochloric Acid	9	6	2
Hydrogen Sulfide	18	9	0
Indene	12	6	2
Iron & Compounds, NOS (Fe)	18	9	0
Isophorone	12	6	0
Isopropyl Ether	9	3	1
Kelthane	15	6	0
Kepone	18	9	0
Lead (Pb)	18	9	0
Lindane	18	9	0
Magnesium & Compounds, NOS (Mg)	15	6	0
Manganese & Compounds, NOS (Mn)	18	9	0
Mercury (Hg)	18	9	0
Mercury Chloride	18	9	0
Methoxychlor	15	6	0
4, 4-Methylene-Bis-(2-Chloroaniline)	18	9	0
Methylene Chloride	12	6	1
Methyl Ethyl Ketone	6	6	0
Methyl Isobutyl Ketone	12	6	0
4-Methyl-2-Nitroaniline	12	9	3
Methyl Parathion	9	9	0
2-Methylpyridine	12	6	0
Mirex	18	9	0
Napthalene	9	6	0
Nickel & Compounds, NOS (Ni)	18	9	0

Table 4 (cont.)

Chemical/Compound	Toxicity/ Persistence[1]	Toxicity[2]	Reactivity[2]
Nitric Acid	9	9	2
Nitroaniline, NOS	18	9	3
Nitrogen Compounds, NOS	12	0	
Nitroguanidine	12	9	3
Nitrophenol, NOS	15	9	2
Parathion	9	9	0
Pentachlorophenol (PCP)	18	9	0
Pesticides, NOS	18	9	0
Phenanthrene	15	9	0
Phenol	12	9	2*
Phosgene	9	9	1
Polybrominated Biphenyl (PBB), NOS	18	9	0
Polychlorinated Biphenyls, NOS	18	9	0
Potassium Chromate	18	9	0
Radium & Compounds, NOS (Ra)	18	9	2
Radon & Compounds, NOS (Rn)	15	9	0
2, 4-D, Salts & Esters	18	9	0
Selenium (Se)	18	9	0
Sevin (Carbaryl)	18	9	0
Sodium Cyanide	12	9	0
Styrene	9	6	1
Sulfate	9	0	0
Sulfuric Acid	9	9	2
1, 1, 2, 2-Tetrachloroethane	18	9	0
Tetrachloroethane, NOS	18	9	0
1, 1, 2, 2-Tetrachloroethene	12	6	0
Tetraethyl Lead	18	9	0
Tetrahydrofuran (I)	~~18~~ 15	6	0
Thorium & Compounds, NOS (Th)	18	9	2
Toluene	9	6	0
Toxaphene	18	9	0
Tribromomethane	18	9	1
1, 2, 4-Trichlorobenzene	15	6	0
1, 1, 1-Trichloroethane	12	6	0

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Table 4 (cont.)

Chemical/Compound	Toxicity/ Persistence[1]	Toxicity[2]	Reactivity[2]
1, 1, 2-Trichloroethane	15	6	0
Trichloroethane, NOS	15	6	0
Trichloroethene	~~18~~ 12	~~9~~ 6	0
1, 1, 1-Trichloropropane	12	6	0
1, 1, 2-Trichloropropane	12	6	0
1, 2, 2-Trichloropropane	12	6	0
1, 2, 3-Trichloropropane	18	9	0
Uranium & Compounds, NOS (U)	18	9	2
Varsol	12	6	0
Vinyl Chloride	15	9	1
Xylene	9	6	0
Zinc & Compounds, NOS (Zn)	18	9	1
Zinc Cyanide	18	9	0
2, 4, 5-T	18	9	0

1 Values for groundwater and surface water routes

2 Values for air route

* Only in pure form; otherwise, 0

REFERENCE 7

(7)

INTERVIEW ACKNOWLEDGEMENT FORM

Site Name	Olin Chemical	**I.D. Number**	50086.10
Person Contacted	Mr. Paul Duggan	**Date**	September 10, 1986
Title	Water and Sewer Department		
Affiliation	Wilmington Town Hall	**Phone Number**	(617) 658-4711
Address	121 Glen Road Wilmington, Massachusetts 01887		
Type of Contact	Telephone Call	**Contact Person(s)**	David B. Thompkins

Interview Summary

- Distribution map of municipal water system is available from Town Engineer.
- Approximately 20 homes are located southwest of the site and are not serviced by municipal water supplies. These homes obtain groundwater from private wells for domestic use.
- Currently there ~~are~~/are not plans to extend the water system to these homes (please circle correct choice).
- The Water Department has no record or history of these wells (i.e., aquifer location, etc.). SEE ATTACHED -
- On the attached map, please indicate the locations of wells and pumping stations for the Town system.
- Estimated population served by the Town system is 17,000 +.

Acknowledgement

I have read the above transcript and I agree that it is an accurate summary of the information verbally conveyed to Wehran Engineering interviewer(s) (as revised below, if necessary).

Revisions (please write in any corrections needed to above transcript)

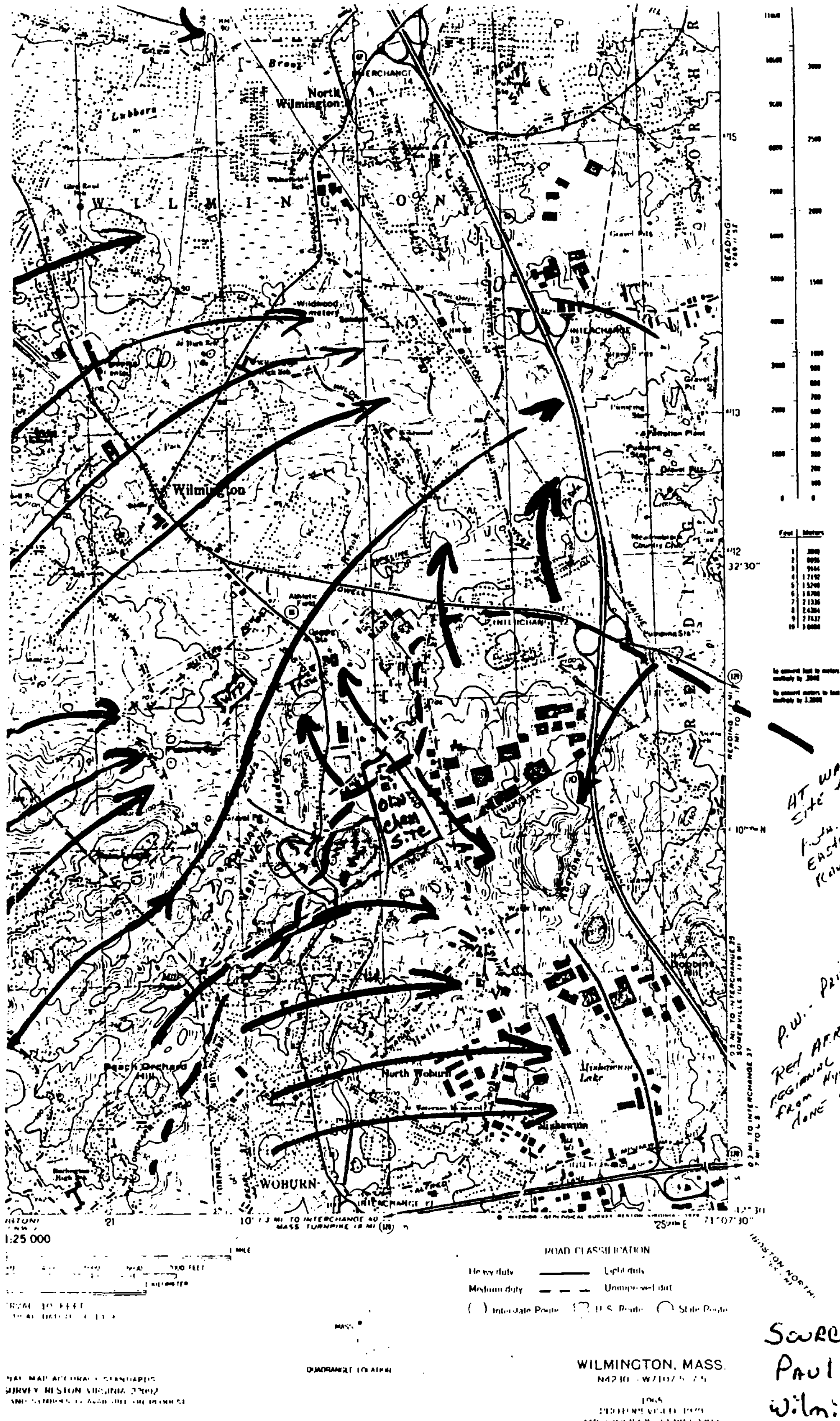
ANY NEW HOMES CONST. IN THE PAST FEW YEARS, ON A PRIVATE WELL, COME UNDER BOARD OF HEALTH JURISDICTION.

Signature Paul Duggan
Supt. Water + Sewer Dept.

Date 9-16-86

REFERENCE 8

Ref 8



AT Water Treatment Plant Site there are 2 wells (GP) 1 to the south and one Easterly also supply Raw water to WTP

P.W. - Private wells

Red Arrows indicate regional groundwater flow from hydrological study done 1983

Source:
Paul Duggan
Wilmington Water Dept.

REFERENCE 9

POPULATION COUNT

Population within a 3-mile radius of each Phase I site is determined using the coordinate system illustrated below. The number of residences for each quadrant and section is determined by overlaying this pattern onto a U.S.G.S. 7.5 minute topographic map. A multiplier of 3.8 persons per residence is used to determine population in accordance with Mitre Model 1985.

A = 1 mile radius

B = 2 mile radius

C = 3 mile radius

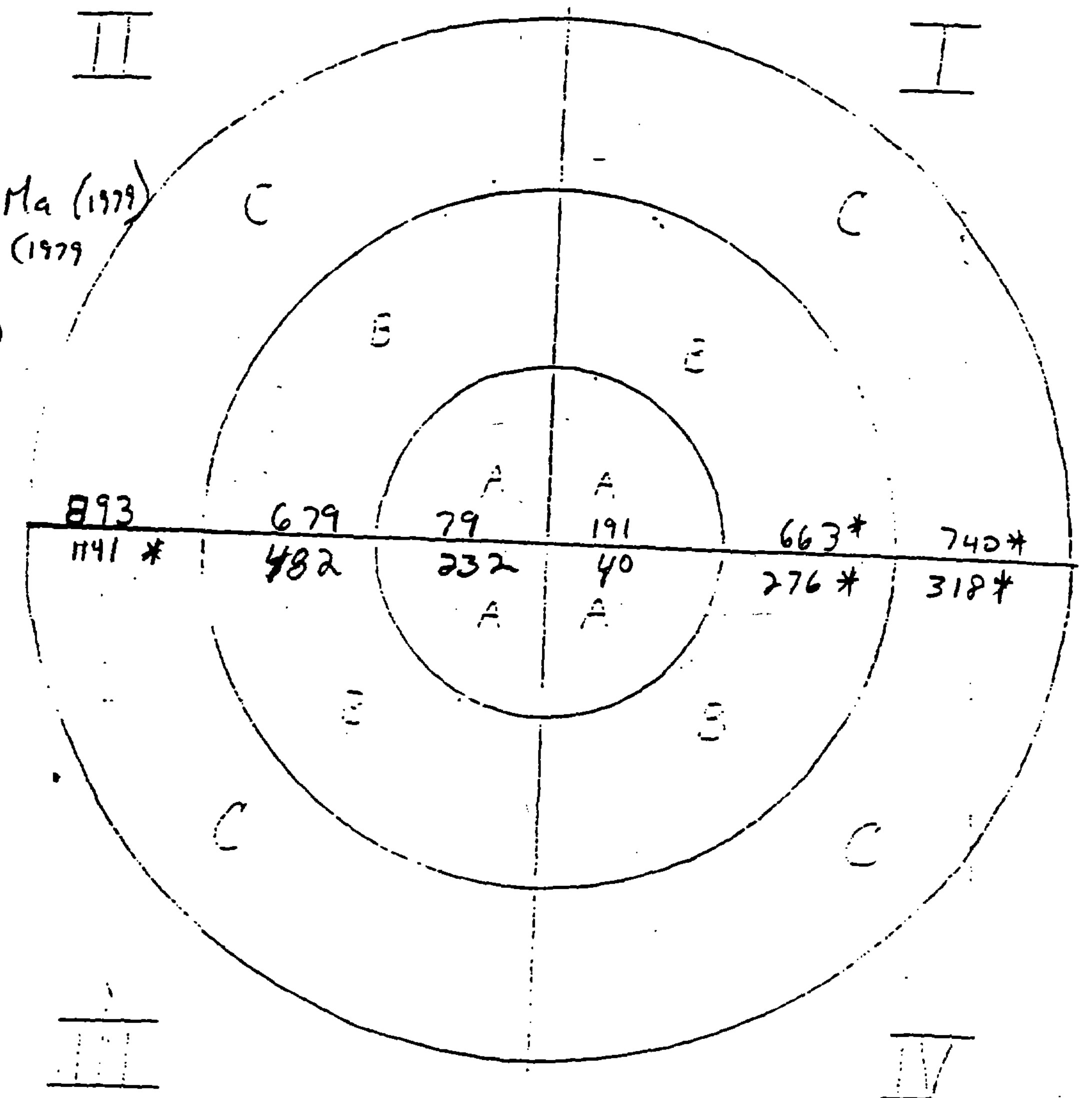
(Figure not To Scale)

USGS House Count

1 mile = 542 houses = 2060 people
2 mile = 2100 houses = 7980 people
3 mile = 3092 houses = 11750 people
Total 5734 houses 21790 people

Quads

Wilmington, Ma (1979)
Boston, North (1979
Lexington (1971)
Reading (1979)



* Includes municipal area — population actually higher than counted

REFERENCE 10

10

The Commonwealth of Massachusetts
SECRETARY OF STATE

REGULATION FILING AND PUBLICATION

1. REGULATION CHAPTER NUMBER AND HEADING:

   314 CMR 1.00 - 30.00

2. NAME OF AGENCY:

   DIVISION OF WATER POLLUTION CONTROL

3. THIS DOCUMENT IS REPRINTED FROM THE CODE OF MASSACHUSETTS REGULATIONS AND CONTAINS THE FOLLOWING:

   314 CMR 1.00 - 30.00 ALL REGULATIONS OF THE DIVISION

UNDER THE PROVISIONS OF MASSACHUSETTS GENERAL LAWS, CHAPTER 30A, SECTION 6 AND CHAPTER 233, SECTION 75 THIS DOCUMENT MAY BE USED AS EVIDENCE OF THE ORIGINAL DOCUMENTS ON FILE WITH THE STATE SECRETARY.

COMPILED AS IN FULL FORCE AND EFFECT 6/30/84

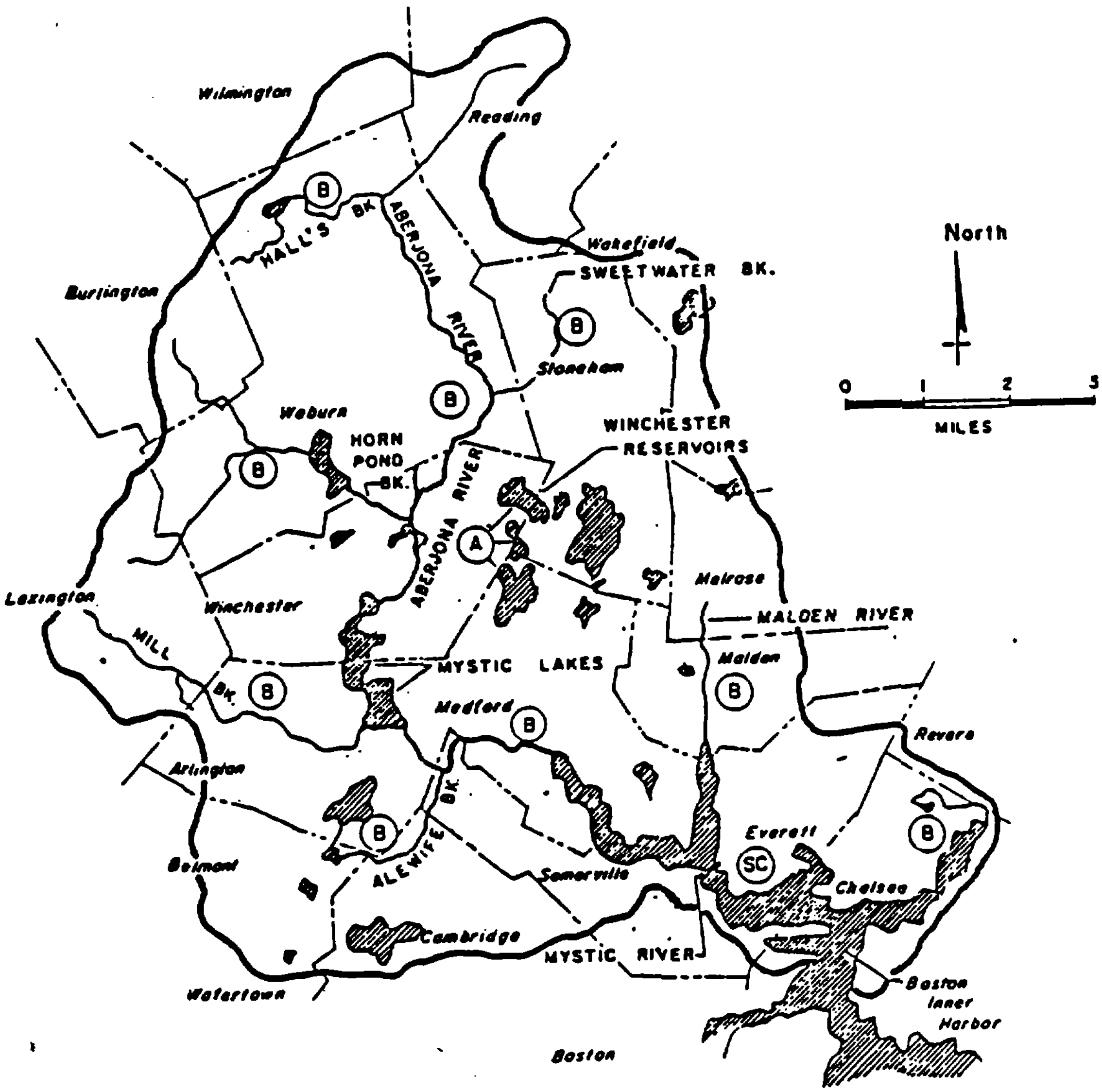
REPRINTED 2/11/85
$8.00

A TRUE COPY, ATTEST

Michael Joseph Connolly

MICHAEL JOSEPH CONNOLLY,

SECRETARY OF STATE



MYSTIC RIVER BASIN

TABLE 18

MYSTIC RIVER BASIN

DRAINAGE AREA 19a

BOUNDARY	MILE POINTS	CLASSIFICATION	DESIGNATED USES	OTHER RESTRICTIONS
Abjerona River				
Source to outlet Mishawam Lake	18.4 - 15.1	B	Warm Water Fishery Recreation (P&S)	Regulation 4.3
Outlet Mishawam Lake to inlet Mystic Lake	15.1 - 9.2	B	Warm Water Fishery Recreation (P&S)	
Upper Mystic Lake	9.2 - 8.1	B	Warm Water Fishery Recreation (P&S)	
Lower Mystic Lake	8.1 - 7.4	B	Warm Water Fishery Recreation (P&S)	
Mystic River				
Outlet Lower Mystic Lake to Amelia Earhart Dam	7.4 - 2.0	B	Warm Water Fishery Recreation (P&S)	
Amelia Earhart Dam to confluence with the Chelsea River	2.0 - 0.0	SC	Marine Fishery Recreation (S)	
Malden River				
Entire Length	1.9 - 0.0	B	Warm Water Fishery Recreation (P&S)	
Alewife Brook				
Entire Length	2.0 - 0.0	B	Warm Water Fishery Recreation (P&S)	
Horn Pond, Woburn	-	B	Warm Water Fishery Recreation (P&S)	Emergency Water Supply
North Reservoir, Middle Reservoir, and South Reservoir in Winchester, Stoneham and Medford	-	A	Public Water Supply	MGL, Ch. 111
Crystal Lake Wakefield and Stoneham	-	A	Public Water Supply	Treated
Other surface waters in the Mystic River Drainage Basin unless otherwise denoted above	-	B	-	Regulation 4.3

4.03: continued

(2) Coordination with Federal Criteria. The Division will use the EPA publication entitled Quality Criteria for Water, EPA-440/9-76-023 as guidance in establishing case-by-case discharge limits for pollutants not specifically listed in these standards but included under the heading "Other Constituents" in 314 CMR 4.03(4), for identifying bioassay application factors and for interpretations of narrative criteria. Where the minimum criteria specifically listed by the Division in 314 CMR 4.03 differ from those contained in the federal criteria, the provisions of the specifically listed criteria in 314 CMR 4.03 shall apply.

(3) Classes and Designated Uses. The waters of the Commonwealth will be assigned to one of the classes listed below. Each class is defined by the most sensitive, and therefore governing, uses which it is intended to protect. The classes are:

Classes for Inland Waters

Class A - Waters assigned to this class are designated for use as a source of public water supply.

Class B - Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; and for primary and secondary contact recreation.

Class C - Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; and for secondary contact recreation.

Classes for Coastal and Marine Waters

Class SA - Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; for primary and secondary contact recreation; and for shellfish harvesting without depuration in approved areas.

Class SB - Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; for primary and secondary contact recreation; and for shellfish harvesting with depuration (Restricted Shellfish Areas).

Class SC - Waters assigned to this class are designated for the protection and propagation of fish, other aquatic life and wildlife; and for secondary contact recreation.

(4) Minimum Criteria. The following minimum criteria are adopted and shall be applicable to all waters of the Commonwealth.

A. These minimum criteria are applicable to all waters of the Commonwealth, unless criteria specified for individual classes are more stringent.

Parameter	Criteria
1. Aesthetics	All waters shall be free from pollutants in concentrations or combinations that: (a) Settle to form objectionable deposits; (b) Float as debris, scum or other matter to form nuisances; (c) Produce objectionable odor, color, taste or turbidity; or (d) Result in the dominance of nuisance species.

REFERENCE 11

Uncontrolled Hazardous Waste Site Ranking System

A Users Manual
(HW-10)

Originally Published in
the July 16, 1982, *Federal Register*

United States
Environmental Protection
Agency

1984

TABLE 2

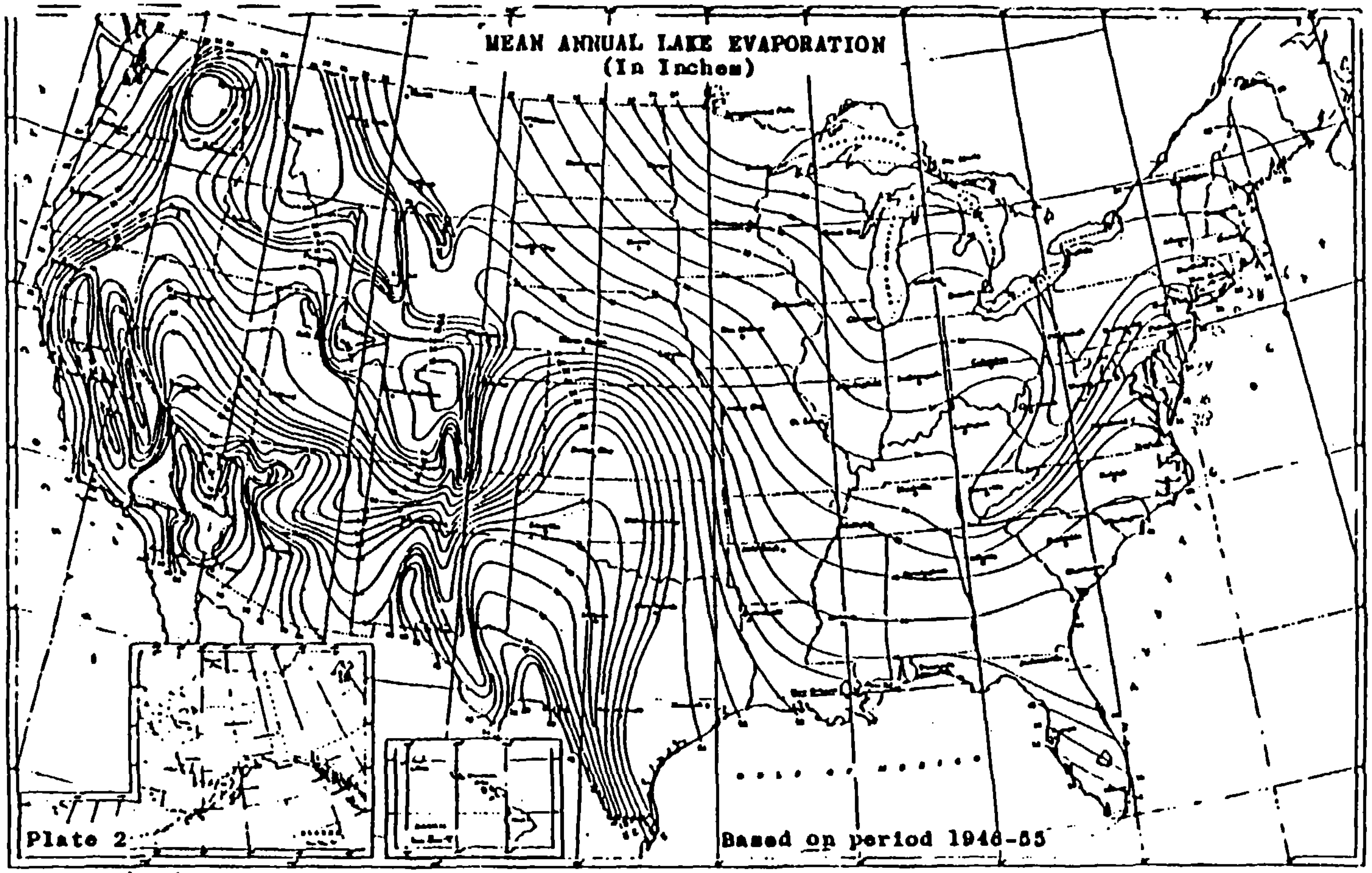
PERMEABILITY OF GEOLOGIC MATERIALS*

Type of Material	Approximate Range of Hydraulic Conductivity	Assigned Value
Clay, compact till, shale; unfractured metamorphic and igneous rocks	$<10^{-7}$ cm/sec	0
Silt, loess, silty clays, silty loams, clay loams; less permeable limestone, dolomites, and sandstone; moderately permeable till	$10^{-5} - 10^{-7}$ cm/sec	1
Fine sand and silty sand; sandy loams; loamy sands; moderately permeable limestone, dolomites, and sandstone (no karst); moderately fractured igneous and metamorphic rocks, some coarse till	$10^{-3} - 10^{-5}$ cm/sec	2
Gravel, sand; highly fractured igneous and metamorphic rocks; permeable basalt and lavas; karst limestone and dolomite	$>10^{-3}$ cm/sec	3

*Derived from:

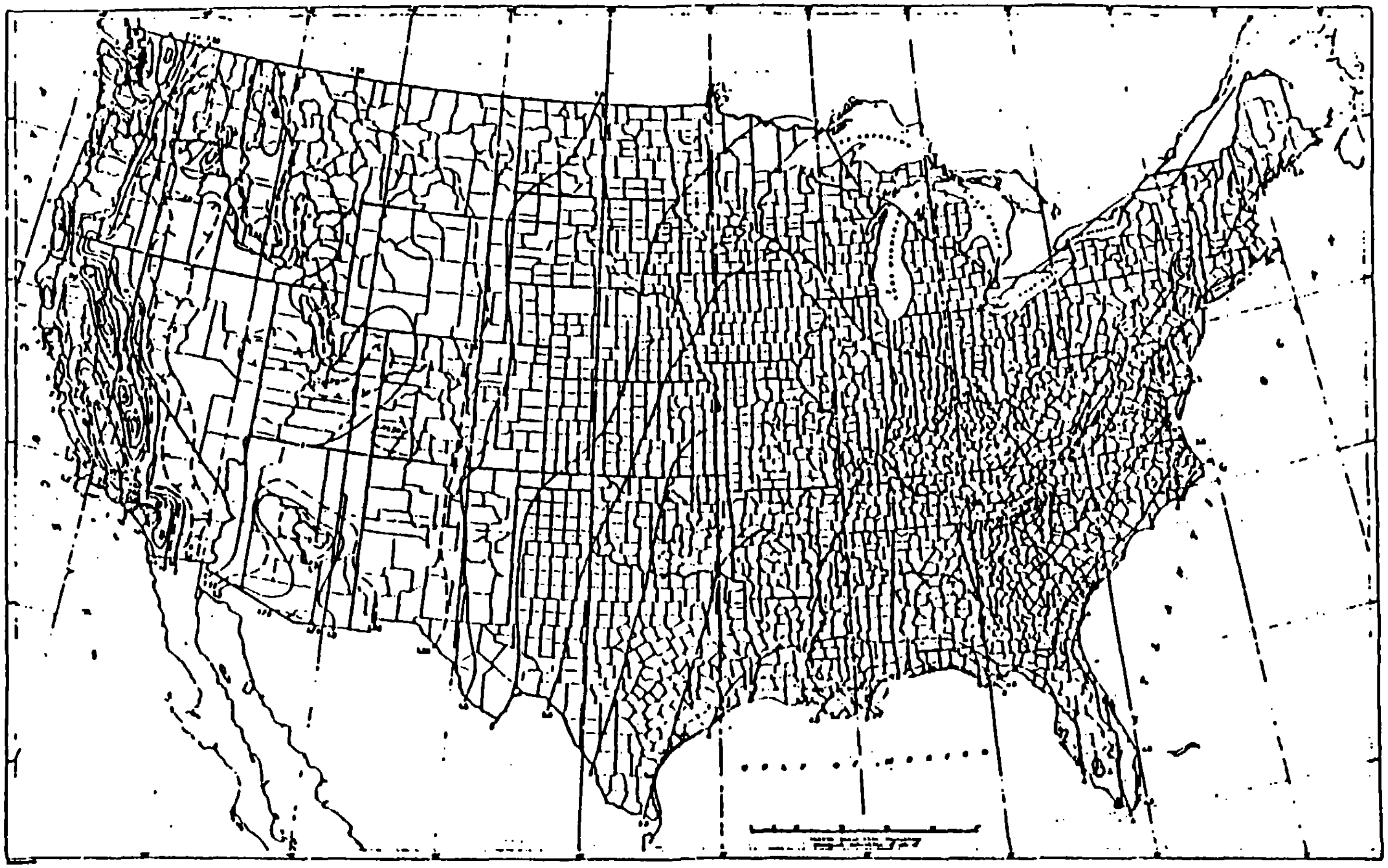
Davis, S. N., Porosity and Permeability of Natural Materials in Flow-Through Porous Media, R.J.M. DeWest ed., Academic Press, New York, 1969

Freeze, R.A. and J.A. Cherry, Groundwater, Prentice-Hall, Inc., New York, 1979



Source: Climatic Atlas of the United States, U.S. Department of Commerce, National Climatic Center, Ashville, N.C., 1979.

FIGURE 4
MEAN ANNUAL LAKE EVAPORATION
(IN INCHES)



Source: Rainfall Frequency Atlas of the United States, Technical Paper No. 40, U.S. Department of Commerce, U.S. Government Printing Office, Washington, D.C., 1963.

FIGURE 8
1-YEAR 24-HOUR RAINFALL
(INCHES)

TABLE 9

CONTAINMENT VALUES FOR SURFACE WATER ROUTE

Assign containment a value of 0 if: (1) all the waste at the site is surrounded by diversion structures that are in sound condition and adequate to contain all runoff, spills, or leaks from the waste; or (2) intervening terrain precludes runoff from entering surface water. Otherwise, evaluate the containment for each of the different means of storage or disposal at the site and assign a value as follows:

A. Surface Impoundment

	Assigned Value
Sound diking or diversion structure, adequate freeboard, and no erosion evident	0
Sound diking or diversion structure, but inadequate freeboard	1
Diking not leaking, but potentially unsound	2
Diking unsound, leaking, or in danger of collapse	3

B. Containers

	Assigned Value
Containers sealed, in sound condition, and surrounded by sound diversion or containment system	0
Containers sealed and in sound condition, but not surrounded by sound diversion or containment system	1
Containers leaking and diversion or containment structures potentially unsound	2
Containers leaking, and no diversion or containment structures or diversion structures leaking or in danger of collapse	3

C. Waste Piles

	Assigned Value
Piles are covered and surrounded by sound diversion or containment system	0
Piles covered, wastes unconsolidated, diversion or containment system not adequate	1
Piles not covered, wastes unconsolidated, and diversion or containment system potentially unsound	2
Piles not covered, wastes unconsolidated, and no diversion or containment or diversion system leaking or in danger or collapse	3

D. Landfill

	Assigned Value
Landfill slope precludes runoff, landfill surrounded by sound diversion system, or landfill has adequate cover material	0
Landfill not adequately covered and diversion system sound	1
Landfill not covered and diversion system potentially unsound	2
Landfill not covered and no diversion system present, or diversion system unsound	3

REFERENCE 12

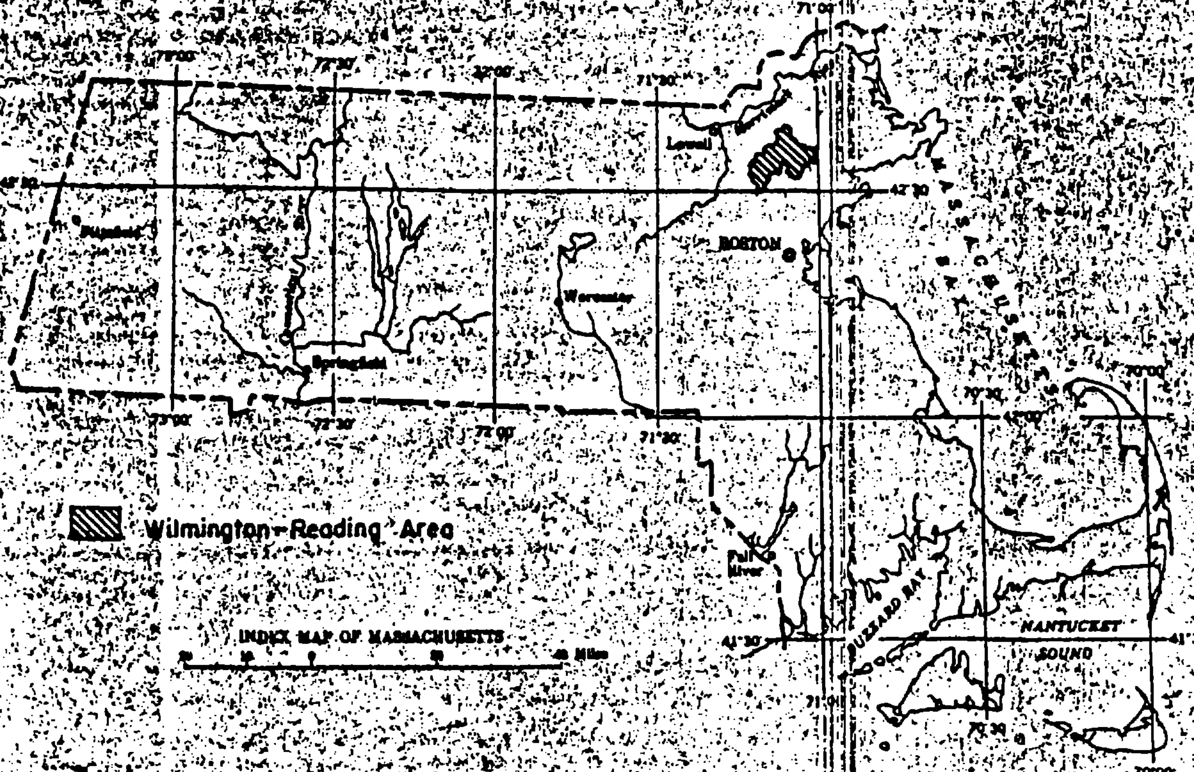
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MASSACHUSETTS BASIC-DATA REPORT NO. 1
GROUND-WATER SERIES

WILMINGTON - READING AREA

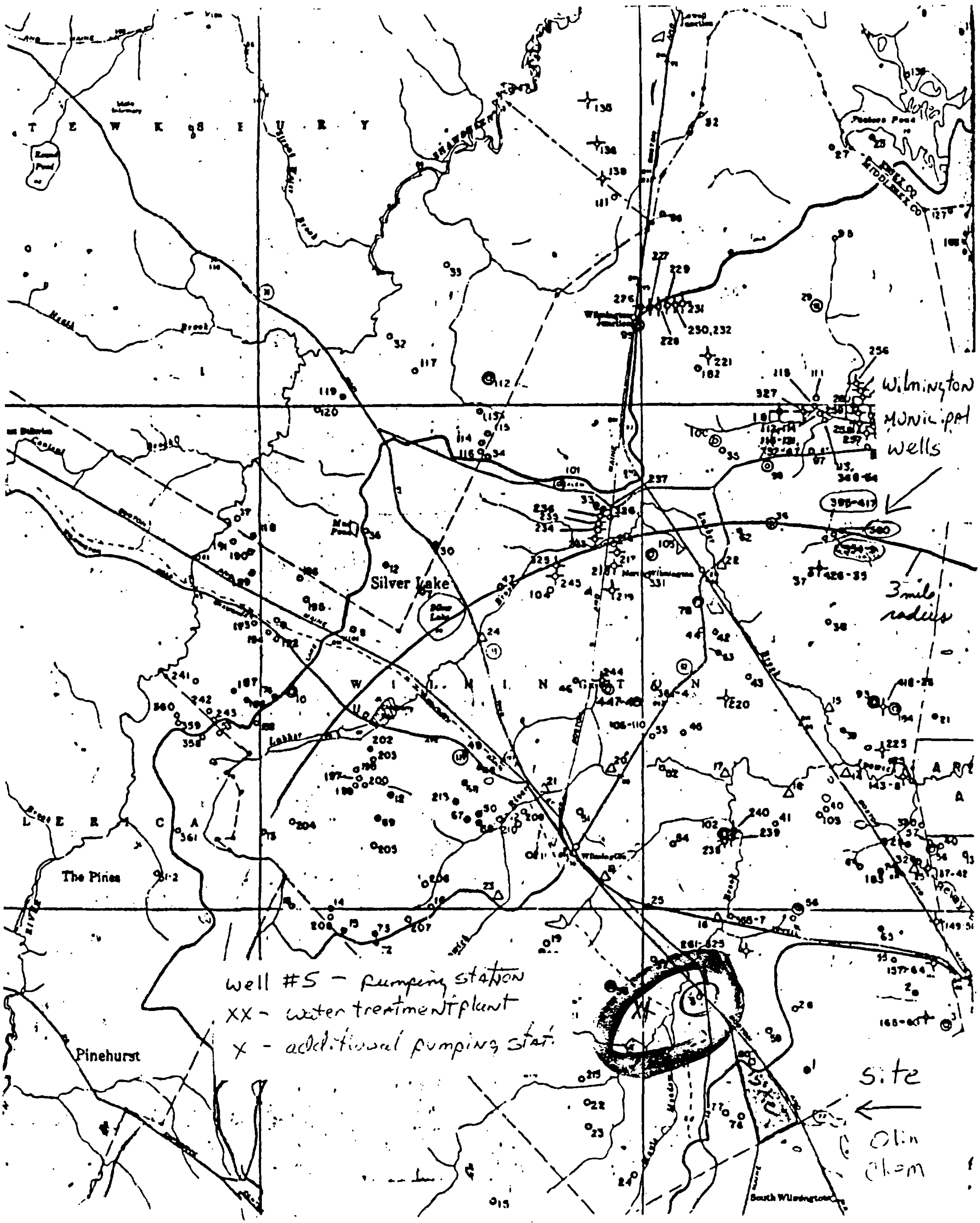
BY

JOHN A. BAKER AND EDWARD A. SAMMEL



PREPARED IN COOPERATION WITH
THE COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS, BOSTON, MASSACHUSETTS

1961



Wilmington municipal wells
3 mile radius
Silver Lake
The Pines
Pinehurst
well #5 - pumping station
XX - water treatment plant
X - additional pumping stat
site
Olin Chem
South Wilmington

Well no.	Location	Owner or user	Year completed	Altitude of land-surface datum (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth to bedrock or refusal (feet)	Water-bearing material: Character	Water-bearing material: Geologic unit	Water: Level	Water: Date of measurement	Use	Type of pump	Remarks
							MIDDLESEX COUNTY (Continued)								
							READING (Continued)								
187	U13-9c	Town of Reading	1957	85	Dn	60	2½	-	Sand and gravel	Ice-contact deposits	3.5	11-16-57	T	None	L. Y 15 at 50 feet; Y 50 at 40 feet; dd 1.5 in observation well 40 feet deep after 5½ hours pumping.
188	U13-9c	do.	1957	85	Dn	55.5	2½	55.5R	do.	do.	0.5	11-21-57	T	None	L. Y 75 at 49 feet; dd 2.5 in observation well 49 feet deep after 8 hours pumping.
189	V13-7a	do.	1957	75	Dn	46	2½	-	do.	-	0.3	11-22-57	T	None	L.
190	U13-9c	do.	1957	75	Dn	40	2½	40 R	do.	-	0.1	12-27-57	T	None	A. L.
191-307	U13-6j	do.	-	75	Dn	-	2½	-	-	-	-	-	PS	C	
317-322	U13-9c	Mass.Dept.Pub.Wks.	1956	87.1-104.5	Dn	20.0-68.2	1	-	-	-	-	-	-	-	A. L.
							TEWKSBURY								
12	U13-5a	Robert Callahan	-	105	Du	22	30	-	Sand and gravel	Ice-contact deposits	-	-	D,S	H	
30	U13-5b	J. F. Crowley	1934	110	Dn	22	1¼	-	Sand	Outwash	-	-	D	S	
32	U13-2g	Mary O'Neill	-	95	Du	13.3	42	-	Sand and gravel	Ice-contact deposits	7.33	12-10-36	D,S	S	Y 2.5.
33	U13-2h	D. J. O'Connell	1924	90	Dn	53	1¼	-	do.	Outwash	-	-	D	S	Water reportedly is "soft".
36	U13-5a	I. N. Mace	1937	100	Dn	18	1½	-	Sand	Ice-contact deposits	-	-	D,S	Pr	Water reportedly is "hard".
37	U13-4c	Stanley Ivas	1920	95	Du	20	6	-	do.	do.	-	-	D,S	H	
111	U13-2f	Bror Berg	1942	100	Du	17.2	36	-	do.	Outwash	6.10	7-27-55	S	S	
112	U13-2h	Bert Allen	-	102	Du	14.4	36	-	Sand and gravel	Ice-contact deposits	9.38	8-22-55	D,O	S	
113	U13-5b	Mr. Jasilewicz	1950	108	Du	18	24	-	do.	do.	-	-	PS	H	Well supplies water for picnic area.
114	U13-5b	do.	1950	112	Du	24.8	30	-	Sand	do.	19.41	8- 6-56	D	-	L. Water reportedly has high iron content.
115	U13-5b	do.	1950	112	Du	15.4	18	-	do.	do.	12.98	8- 6-56	D	H	
116	U13-5b	T. J. Morrissey	1950	110	Du	18	36	-	do.	do.	11.55	8- 6-56	N	None	
117	U13-2h	L. D. Smith	-	100	Du	10.7	36	-	Sand and gravel	do.	6.63	8-22-56	N	None	
118	U13-4c	A. Smoller	1956	115	Dr	92	6	30	-	Bedrock	19.19	8-22-56	D	-	
119	U13-2g	V. H. Gray	-	87	Dr	86	4	36	-	do.	-	-	D	-	Y 10. Well reportedly overflows.
120	U13-5a	E. R. Beechin	-	90	Du	7.5	48	-	Sand	Ice-contact deposits	3.80	8-23-56	D	-	
							WILMINGTON								
1	U13-9b	John Rebetski	1937	75	Du	16.7	24	0	-	Till	13.74	8-18-39	D,S	Pl	
2	U13-9c	Rochefort	-	90	Du	9.7	18	-	-	do.	5.77	8-25-39	-	-	A.
3	U13-9c	J. S. Kemp	-	100	Du	10.1	24	-	-	Ice-contact deposits	8.03	8-25-39	D,S,O	S	
5	U13-9a	Town of Wilmington	1937	95	Du	14	20	-	Sand	Outwash	-	-	D	[illegible]	

REFERENCE 13

TELEPHONE CONVERSATION MEMORANDUM

CLIENT MDEQE

PROJ. No. 50086.10

PROJECT Olin Chemical

DATE September 25, 1986

TIME

CALL TO/FROM Randi Augustine

REPRESENTING Wehran Engineering
Methuen, MA office

PHONE No. ext. 2002

SUMMARY OF CONVERSATION:

Randi is investigating Raffi and Swanson, Inc. located on Eames Street, Wilmington, MA. Their facility is located northeast of the Olin site, approximately 300 feet.

During information search, Randi had contacted Joanne Michaud from the Massachussets National Heritage Program. Ms. Michaud indicated there are no federally endangered species in the vicinity of Eames Street. She did indicate that several Massachussets endangered species were in the area.

Documentation to follow. (Not available at time of printing).

Ms. Joanne Michaud
Massachussets National
Heritage Program
100 Cambridge Avenue
Boston, MA 02202

(617) 727-9194

COPIES TO:

BY:

David B. Tompkins

WEHRAN ENGINEERING
CONSULTING ENGINEERS

REFERENCE 14

#14

TELEPHONE CONVERSATION MEMORANDUM

CLIENT MDEQE

PROJ. No. 5008610

PROJECT Olin Chemical Company

DATE 9/23/86

TIME

CALL TO/FROM Engineering and Health Depts

REPRESENTING

PHONE No. as indicated below

SUMMARY OF CONVERSATION:

Carol Coggan - Woburn Engineering Dept. - (617) 933-0700

- Sent copies of municipal system map, wells G,H are wells involved in W.R. Grace - Leukemia problem. Well not utilized any more. Presently obtain two million gallons per day from MDC.

- No information on local wells, they could exist within three miles of site.

Mike Taddeo - Reading Engineering Dept. - (617) 942-0500

- Sent for two copies of municipal system ($7.65)

- No information on private wells

Reading Health Department - will send a list of private wells with addresses

Burlington Engineering Dept. (617) 272-6700

- Will send photocopy of water system; no information on private wells, neither does the Health Dept.

COPIES TO:

BY: DBT

David B. Tompkins

WEHRAN ENGINEERING
CONSULTING ENGINEERS

PHASE I

SITE INSPECTION REPORT

APPENDIX B-C

For The

OLIN CHEMICAL GROUP

Wilmington, Massachusetts, Middlesex County

SEPTEMBER 1986

DRAFT

OCT 2 1986

MASSACHUSETTS

FIELD INVESTIGATION TEAM

WEHRAN ENGINEERING CORP.

Engineers & Scientists

Methuen, MA 01844

APPENDIX B

OLIN CHEMICAL 3007/3004U RESPONSE FORM

OC-10000A

INTER OFFICE MEMO Olin

TO Distribution AT Various DATE August 14, 1986

FROM J.W. O'Grady AT Charleston COPY TO

SUBJECT Wilmington 3007/3004U Response

Please find attached your copy of the subject report as submitted.

JW O'Grady
J.W. O'Grady jm

jmm
Attachment

DISTRIBUTION:
A.M. Houston (w/o documentation)
R.J. McBrien
V.M. Norwood
R.B. Sherwood
M. Townley
D.R. Vaughn
File

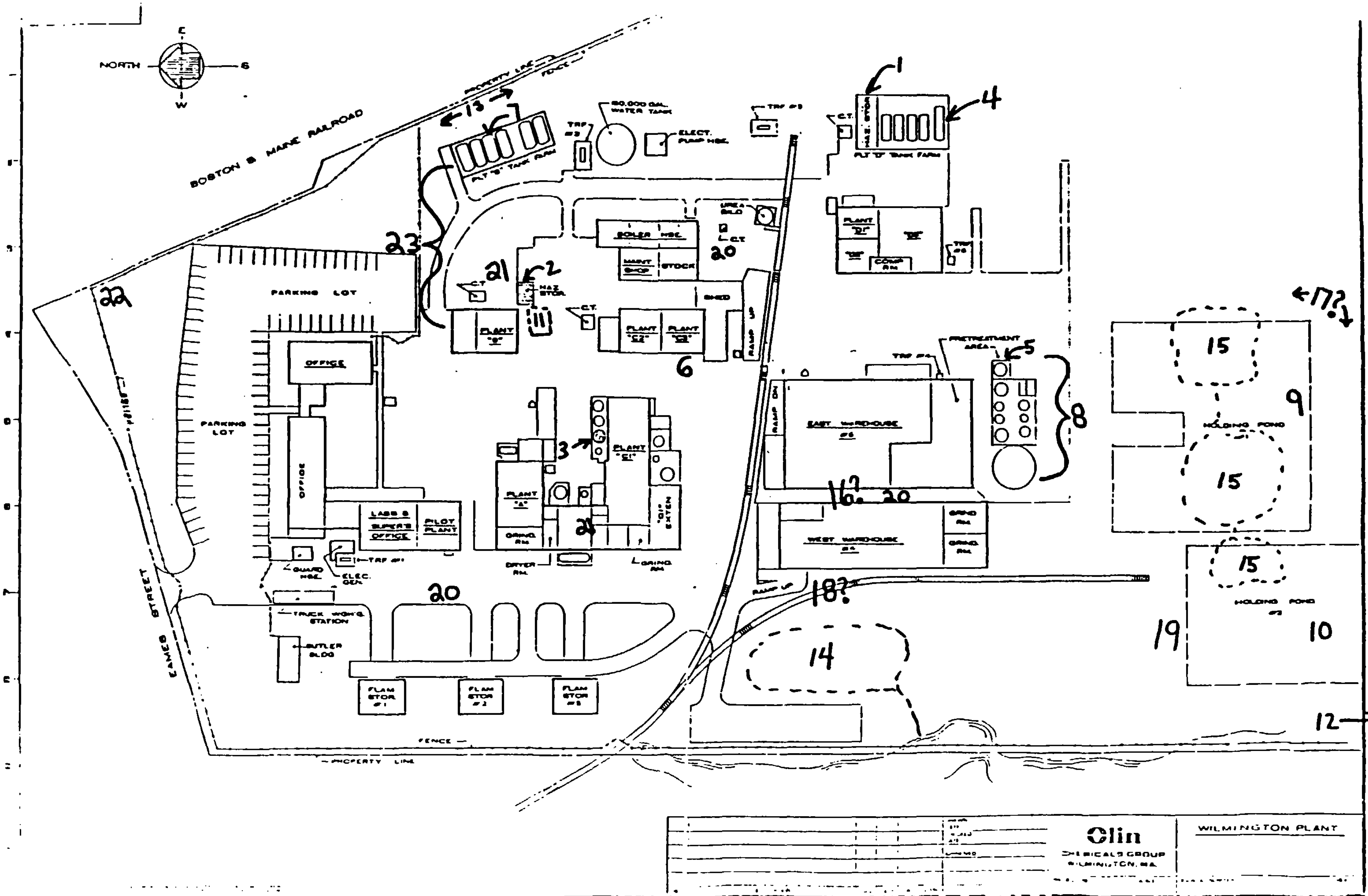
WHY FILE THIS COPY? IF YOU MUST RETAIN IT, SPECIFY A DEFINITE RETENTION PERIOD: ONE YEAR ______ OTHER ______

SWMU

1. Plant D Drum Storage Unit
2. Plant B Drum Storage Unit
3. By-Product HCl Tank
4. By-Product Ammonium Hydroxide Tank
5. By-Product Ammonium Hydroxide Tank
6. By-Product Ammonium Hydroxide Tank (Removed)
7. By-Product Ammonium Hydroxide Tank
8. Wastewater Treatment Plant
9. Lagoon I
10. Lagoon II
11. Plant B Pit
12. Calcium Sulfate Landfill
13. Interceptor Well System
14. Lake Poly
15. Acid Pits
16. Trench in the Vicinity of the East and West Warehouses
17. Opex Vicinity of Lagoon I
18. Opex Drums West of West Warehouse
19. Drums North of Lagoon II
20. Septic Tank, Active
21. Tile Field, Inactive

OTHER

22. PCB Capacitor
23. Plant B Production Area and Tank Farm


NORTH
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BOSTON & MAINE RAILROAD
PROPERTY LINE
FENCE
PLT "B" TANK FARM
80,000 GAL. WATER TANK
ELECT. PUMP HSE.
TRF #3
TRF #2
C.T.
PLT "D" TANK FARM
HAZ. STOR.
UREA SILO
BOILER HSE.
MAINT SHOP
STOCK
SHED
RAMP UP
PLANT "D"
COMP RM
TRF #6
PARKING LOT
PLANT "B"
HAZ STOR.
PLANT "C2"
PLANT "C3"
OFFICE
PARKING LOT
PLANT "C1"
PLANT "A"
"C1" EXTEN
GRIND RM
DRYER RM
LABS & SUPER'S OFFICE
PILOT PLANT
GUARD HSE.
ELEC. GEN.
TRF #1
TRUCK WGH'G STATION
BUTLER BLDG
FLAM STOR #1
FLAM STOR #2
FLAM STOR #3
EAMES STREET
FENCE
PROPERTY LINE
PRETREATMENT AREA
TRF #4
EAST WAREHOUSE #5
WEST WAREHOUSE #4
GRIND RM
RAMP DN
RAMP UP
HOLDING POND
HOLDING POND #2
Olin
CHEMICALS GROUP
WILMINGTON, MA.
WILMINGTON PLANT
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Olin CHEMICALS

P.O. BOX 248, CHARLESTON, TN 37310, (615) 336-4000

July 30, 1986

Ms. Lynn Cusick
U. S. Environmental Protection Agency
Waste Management Division
J. F. Kennedy Federal Building - Room 1903
Boston, Massachusetts 02203

CERTIFIED MAIL --
RETURN RECEIPT REQUESTED

Re: Olin Corporation
Wilmington, Massachusetts
EPA I. D. No. MAD001403104

Dear Ms. Cusick:

As requested, please find attached information prepared pursuant to Section 3007 of the Resource Conservation and Recovery Act, 42 USC Section 6927, and Section 104 of the Comprehensive Environmental Response Compensation and Liability Act of 1980, 42 USC 9604. Olin purchased this facility on September 15, 1980. Information contained in this disclosure pertaining to events prior to that date was developed by searching those records that were available to us and through employee interviews. Accordingly, we cannot attest to the accuracy or the completeness of the information prior to Olin's purchase. Should you require additional information prior to September 15, 1980, please contact Stepan Chemical Company, Northfield, Illinois. [redacted]

For review purposes, the attachments have been divided into three appendices: Appendix A contains location maps showing the location of the various solid waste management units, as well as any other known units whether currently in operation or not, which hold or have held hazardous substances and from which there have been reported releases of hazardous constituents. This information is provided in response to Questions 1a and 2a. A topographic map of the facility showing contours at 5 feet or less (as requested) is not available due to the fact that a Part B application is not being prepared/filed. Alternately, we have provided the best maps that are available of the facility including a USGS topographic map. Also, we are not aware of any drinking water wells or surface water drinking supplies within 1,000 feet of the boundaries of our facility. The creeks and streams which flow near and through the facility flow to the Aberjona River.

Appendix B of the attachments contain responses to items b through g for both questions 1 and 2 as identified in your letter.

[redacted] contains information pertaining to remedial work, groundwater studies ~~and field~~ investigation work reports (USEPA) performed at this facility.

Ms. Lynn Cusick
Page 2
July 30, 1986

Only incidents involving more than the reportable quantity (RQ) as established by the USEPA have been included in today's submittal. In some other non-RQ cases, local or state agencies were notified at the time of occurrence.

I trust the enclosed information adequately responds to your inquiries. Should you have any questions with today's submission, please contact Mr. Jack W. O'Grady at 615/336-4541.

Very truly yours,

OLIN CORPORATION

Verrill M. Norwood, Jr.

Verrill M. Norwood, Jr.

VMN/vrp
040/VMN7
Attachments

cc: Mr. David Berry
Massachusetts Department of
Environmental Quality & Engineering
Division of Solid and Hazardous Waste Management
One Winter St.
Boston, MA 02108

Ruby Sherwood - Stamford

APPENDIX A

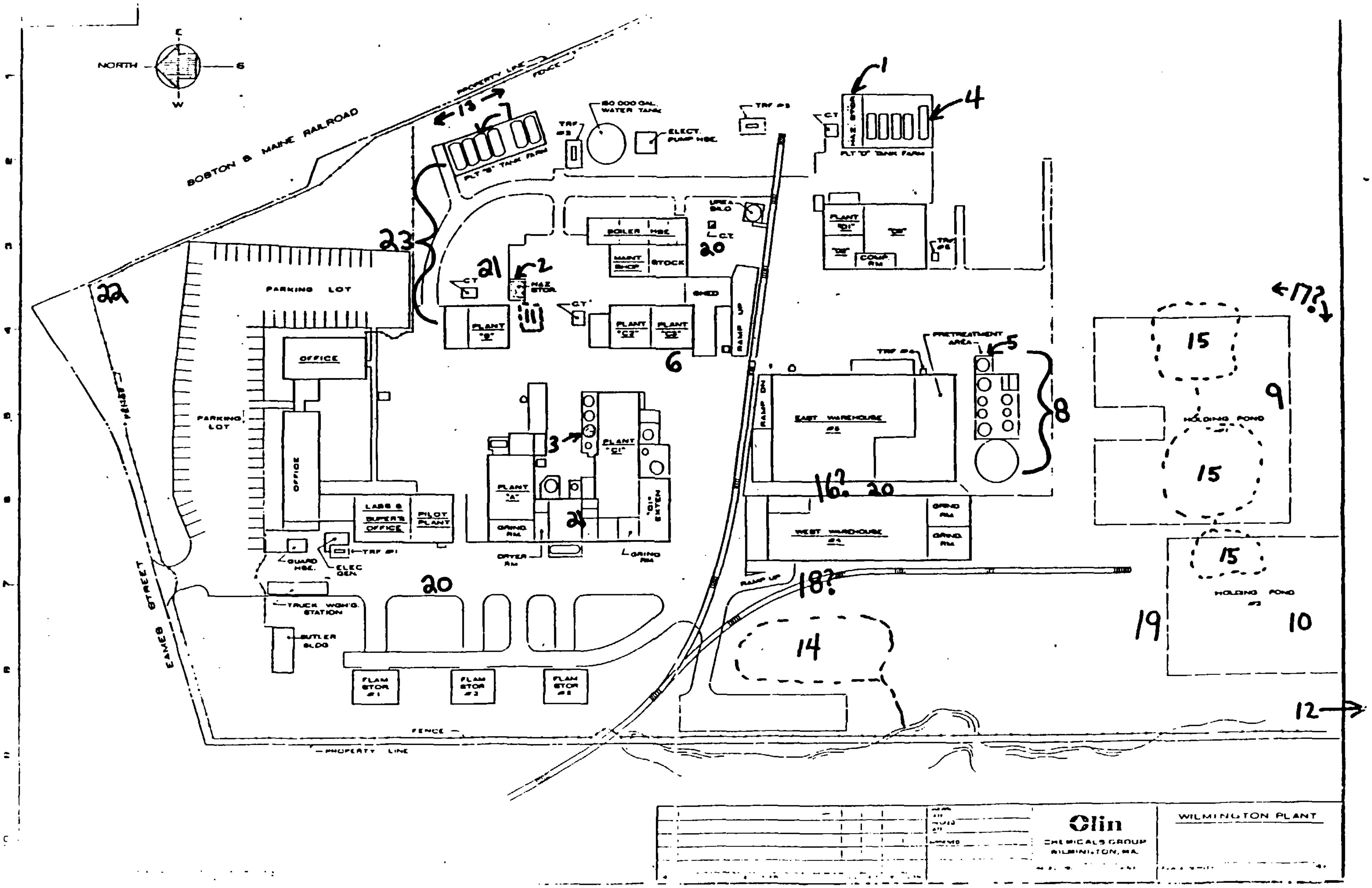
LOCATION MAPS

SWMU

1. Plant D Drum Storage Unit
2. Plant B Drum Storage Unit
3. By-Product HCl Tank
4. By-Product Ammonium Hydroxide Tank
5. By-Product Ammonium Hydroxide Tank
6. By-Product Ammonium Hydroxide Tank (Removed)
7. By-Product Ammonium Hydroxide Tank
8. Wastewater Treatment Plant
9. Lagoon I
10. Lagoon II
11. Plant B Pit
12. Calcium Sulfate Landfill
13. Interceptor Well System
14. Lake Poly
15. Acid Pits
16. Trench in the Vicinity of the East and West Warehouses
17. Opex Vicinity of Lagoon I
18. Opex Drums West of West Warehouse
19. Drums North of Lagoon II
20. Septic Tank, Active
21. Tile Field, Inactive

OTHER

22. PCB Capacitor
23. Plant B Production Area and Tank Farm



NORTH
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BOSTON & MAINE RAILROAD
PROPERTY LINE
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PLT "B" TANK FARM
TRF #3
150 000 GAL. WATER TANK
ELECT. PUMP HSE.
TRF #5
C.T.
HAZ. STOR.
PLT "D" TANK FARM
UREA SILO
BOILER HSE
MAINT SHOP
STOCK
PLANT "D1"
"D2"
"D3"
COMP. RM
PARKING LOT
PLANT "B"
PLANT "C2"
PLANT "C3"
SHED
RAMP UP
OFFICE
PARKING LOT
OFFICE
PRETREATMENT AREA
EAST WAREHOUSE #5
RAMP DN
PLANT "C1"
PLANT "A"
LABS & SUPER'S OFFICE
PILOT PLANT
GRIND RM
DRYER RM
"D1" EXTEN
HOLDING POND #1
HOLDING POND #2
WEST WAREHOUSE #4
RAMP UP
GUARD HSE.
ELEC GEN.
TRF #1
TRUCK WGH'G STATION
BUTLER BLDG
FLAM STOR #1
FLAM STOR #2
FLAM STOR #3
EAMES STREET
FENCE
PROPERTY LINE
Olin
CHEMICALS GROUP
WILMINGTON, MA.
WILMINGTON PLANT
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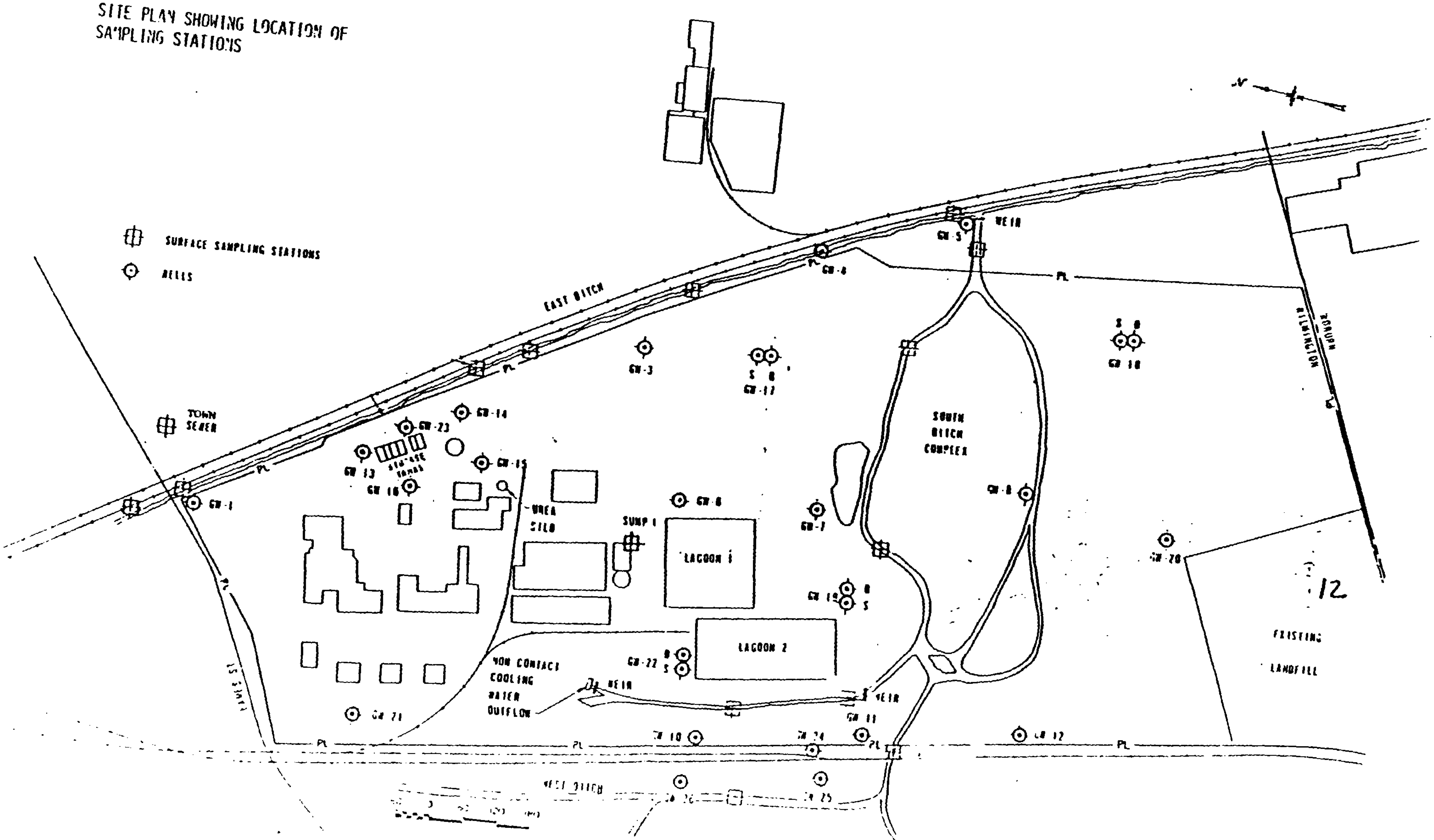
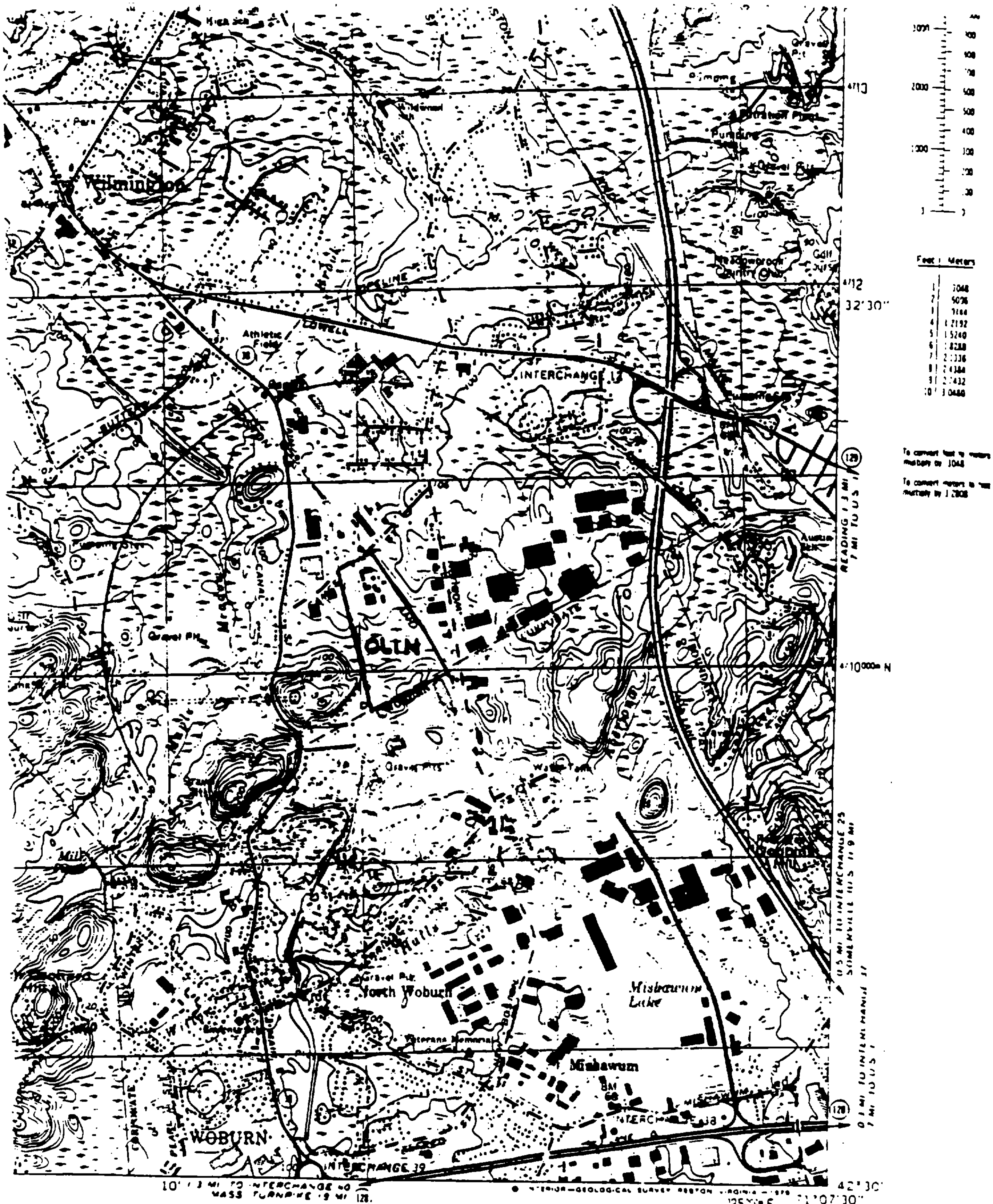
SITE PLAN SHOWING LOCATION OF SAMPLING STATIONS



OLIN WILMINGTON MA
Monitoring wells



Wilmington Quadrangle

ROAD CLASSIFICATION

Heavy duty		Light duty	
Medium duty		Unimproved dirt	
Interstate Route		U. S. Route	State Route

APPENDIX B

HAZARDOUS WASTE STORAGE UNITS

QUESTION 1:

SWMU: Plant B Drum Storage

b) Type of Unit: Storage Area

Dimensions: 12 ft. x 18 ft. x 5 in.

Information on how unit was designed, constructed, operated and maintained: Concrete pad with curb and 6' chain link fence. Gate kept locked except when drums added or removed. Weekly inspections.

c) Date in use: 1980-1986. Closure plan submitted April 14, 1986 (see attached)

d) Quantity and Type(s) of wastes managed in unit: Unit had capacity for up to 88 drums. Types of waste stored in unit: P105, U028, U154, D008, D001, M001. See attached Part A for additional information.

e) Releases of hazardous wastes or hazardous constituents: None

Date: N/A

Quantity: N/A

Type: N/A

f) Information, date and documentation concerning any releases: N/A

g) Corrective actions: None required

QUESTION 1:

SWMU: Plant D Drum Storage

b) Type of Unit: Storage Area

Dimensions: 18.7' x 46.2' x 5 inch

Information on how unit was designed, constructed, operated and maintained: Concrete pad with 6' chain link fence. Gate kept locked except when drums placed in or moved out. Weekly inspections took place.

c) Date in use: 1980-1986. Closure plans submitted April 14, 1986 (see attached)

d) Quantity and Type(s) of wastes managed in unit: Unit had capacity for up to 320 drums. Types of hazardous waste stored in unit: P105, U028, U154, D008, D001, M001. See attached Part A for additional information. characteristic?

lead ignitable, but not hazardous

e) Releases of hazardous wastes or hazardous constituents: None

Date: N/A

Quantity: N/A

Type: N/A

f) Information, data and documentation concerning any releases: N/A

g) Corrective actions: None required

QUESTION 1:

SWMU: HCl Tank

b) Type of Unit: Storage Tank

Dimensions: 10,310-gallon fiberglass tank

Information on how unit was designed, constructed, operated and maintained: Tank located in concrete dike approximately 59 ft. x 18 ft. x 2.5 ft. Inspected weekly.

c) Date in use: 1980-1986. Closure plan submitted April 1986 (see attached)

d) Quantity and Type(s) of wastes managed in unit: Up to 10,310 gallons of 33.3% by product HCl. HCl occasionally neutralized and discharged through on-site treatment plant. See attached Part A for additional information.

e) Releases of hazardous wastes or hazardous constituents: None

Date: N/A

Quantity: N/A

Type: N/A

f) Information, data and documentation concerning any releases: N/A

g) Corrective actions: None required

Olin CHEMICALS GROUP
51 EAMES STREET, WILMINGTON, MA 01887

April 14, 1986

Mr. William R. Cass, Director
DEQE
Division of Solid and Hazardous Waste
One Winter Street, 5th Floor
Boston, Massachusetts 02108

Re: Olin Corporation
Wilmington, MA
EPA ID No. MAD 001403104

Dear Mr. Cass:

Olin Corporation hereby requests that the status of its Wilmington facility be changed from "Interim" to "Generator" only. We are also taking this opportunity to notify, both the State and USEPA that Olin is withdrawing its Part A application and will not be making an application for a Part B permit.

Attached for your review and approval are closure plans for the units currently operated at our facility. These are: 2 drum storage units and a storage tank. Upon completion of closure, the drum storage units will be utilized for on-site accumulation pursuant to 310 CMR 30.340. The tank will no longer be utilized for hazardous waste storage.

Should you have any questions or comments, please contact Mr. James Martucci at 617/933-4240 or Mr. Jack O'Grady at 615/336-4541.

Sincerely,

Ronald J. McBrien

R. J. McBrien
Plant Manager JFM

RJM/JWO/wsr
cc: Mr. Gary Gosbee, USEPA Region I
Mr. Richard Chalpin, DEQE, Northeast Region
Mr. Greg Erickson, Director Board of Health
Mr. Steve Dreeszen, DEQE, Chief Licensing and Engineering Branch
Mr. J. F. Martucci
Mr. J. W. O'Grady
Mr. R. B. Sherwood

OLIN CORPORATION
WILMINGTON, MASSACHUSETTS

CLOSURE PLAN

SCHEDULE OF FINAL CLOSURE - PLANT D DRUM STORAGE UNIT

A. Estimated year of closure - 1986

B. Final date waste will be added to this storage unit: April 15, 1986. Unit will no longer be utilized for storage of waste greater than 90 days after this date. Unit will be utilized for accumulation per 310 CMR 30.340.

C. Date that all inventory will be removed: 90 days after plan approval

D. Completion of facility decontamination: 135 days after plan approval

E. Final date for closure completion: 180 days after plan approval

F. Total time to close unit: 180 days

The Department of Environmental Quality and Engineering must be notified at least six months before closure is expected to begin and a copy of the latest closure plan must be submitted at that time.

SEQUENCE OF CLOSURE EVENTS

The Plant D drum storage unit receives wastes from throughout the facility. It is constructed of concrete and has inner dimensions of 18.7 ft. x 46.2 ft. x 5 in. The estimated maximum capacity of the drum storage unit is 320 drums.

Phase I - Removal of Inventory

A. For the purposes of this Closure Plan, it will be assumed that the unit is completely full and contains 320 drums of various hazardous wastes generated at the facility. All of the hazardous wastes stored in drums will be disposed of in the following manner:

1. Properly label all of the drums in accordance with the applicable Federal and State transportation regulations.

2. Prepare a hazardous waste manifest before shipment.

3. A transporter who is licensed by the Environmental Protection Agency and the State of Massachusetts will haul all of the hazardous waste stored at this facility to a disposal facility.

4. The disposal facility must have all necessary Federal and State operating permits.

5. Olin Corporation will ensure that the hazardous waste manifest used is properly filled out and returned to the proper authorities.

Phase II - Decontamination of the Facility

A. After removal of all wastes from the unit, the inner area will be hydroblasted to remove any residues accumulated over its operating life. All water generated will be tested, and if it meets the parameters of the facility MDC discharge permit, it will be processed through the plant pretreatment facility. If not, the material will be collected and sent off-site to a properly permitted facility.

B. On completion of the hydroblasting, any discolored areas will be abrasive blasted until all residues are removed. All material generated from this abrasive blasting will be drummed and shipped off-site to a properly permitted facility. After completion of cleaning, the dike walls and base will be tested for Bis(2-ethylhexyl) phthalate, sodium azide and EP metals. Should any be present at significant levels, the unit will be recleaned and retested.

C. On completion of the decontamination, the unit will be inspected by and the closure will be certified by an independent Massachusetts registered professional engineer and by Olin that the facility has been closed in accordance with the specifications in the Closure Plan.

OLIN CORPORATION
WILMINGTON, MASSACHUSETTS

CLOSURE PLAN

SCHEDULE OF FINAL CLOSURE - PLANT B DRUM STORAGE UNIT

A. Estimated year of closure - 1986

B. Final date waste will be added to this storage unit: April 15, 1986. Unit will no longer be utilized for storage of wastes for greater than 90 days after this date. Unit will be utilized for accumulation per 310 CMR 30.340.

C. Date that all inventory will be removed: 90 days after plan approval

D. Completion of facility decontamination: 135 days after plan approval

E. Final date for closure completion: 180 days after plan approval

F. Total time to close unit: 180 days

The Department of Environmental Quality and Engineering must be notified at least six months before closure is expected to begin and a copy of the latest closure plan must be submitted at that time.

SEQUENCE OF CLOSURE EVENTS

The Plant B drum storage unit receives wastes from throughout the facility. It is constructed of concrete and has inner dimensions of 12 ft. x 18 ft. x 5 in. The estimated maximum capacity of the drum storage unit is 88 drums.

Phase I - Removal of Inventory

A. For the purposes of this Closure Plan, it will be assumed that the unit is completely full and contains 88 drums of various hazardous wastes generated at the facility. All of the hazardous wastes stored in drums will be disposed of in the following manner:

1. Properly label all of the drums in accordance with the applicable Federal and State transportation regulations.

2. Prepare a hazardous waste manifest before shipment.

3. A transporter who is licensed by the Environmental Protection Agency and the State of Massachusetts will haul all of the hazardous waste stored at this facility to a disposal facility.

4. The disposal facility must have all necessary Federal and State operating permits.

5. Olin Corporation will ensure that the hazardous waste manifest used is properly filled out and returned to the proper authorities.

Phase II - Decontamination of the Facility

A. After removal of all wastes from the unit, the inner area will be hydroblasted to remove any residues accumulated over its operating life. All water generated will be tested, and if it meets the parameters of the facility MDC discharge permit, it will be processed through the plant pretreatment facility. If not, the material will be collected and sent off-site to a properly permitted facility.

B. On completion of the hydroblasting, any discolored areas will be abrasive blasted until all residues are removed. All material generated from this abrasive blasting will be drummed and shipped off-site to a properly permitted facility. After completion of cleaning, the dike walls and base will be tested for Bis(2-ethylhexyl) phthalate, sodium azide and EP metals. Should any be present at significant levels, the unit will be recleaned and retested.

C. On completion of the decontamination, the unit will be inspected by and the closure will be certified by an independent Massachusetts registered professional engineer and by Olin that the facility has been closed in accordance with the specifications in the Closure Plan.

OLIN CORPORATION
WILMINGTON, MASSACHUSETTS

CLOSURE PLAN

SCHEDULE OF FINAL CLOSURE - BY-PRODUCT HCl TANK

A. Estimated year of closure - 1986

B. Final date waste will be added to this storage unit: April 15, 1986. Unit will no longer be utilized for storage of wastes for greater than 90 days after this date.

C. Date that all inventory will be removed: 90 days after plan approval

D. Completion of facility decontamination: 135 days after plan approval

E. Final date for closure completion: 180 days after plan approval

F. Total time to close unit: 180 days

The Department of Environmental Quality and Engineering must be notified at least six months before closure is expected to begin and a copy of the latest closure plan must be submitted at that time.

SEQUENCE OF CLOSURE EVENTS

The by-product HCl tank is constructed of fiberglass and has a volume of 10,310 gallons. It contains 33% hydrochloric acid. It is located in a concrete dike approximately 59 ft. x 18 ft. x 2.5 ft. For the purposes of this Closure Plan, it is assumed that the tank is completely full at closure.

Phase I - Removal of Inventory

A. For the purposes of this Closure Plan, it will be assumed that the unit is completely full and contains 10,310 gallons of liquid muriatic acid generated at the facility. The material will most likely be neutralized at the facility and discharged through our pretreatment plant per our MDC permit. However, for the purposes of this Closure Plan, it will be assumed that the material will either be shipped out in bulk or drummed prior to off-site disposal as this would cause the greatest expenditure of funds. The following steps will be taken:

   1. Proper labeling of all drums in accordance with applicable Federal and State transportation regulations or proper placarding of the hazardous waste bulk transport vessel.

   2. Preparation of a hazardous waste manifest before shipment.

3. Use of a transporter who is licensed by the Environmental Protection Agency and the State of Massachusetts for hauling of the hazardous waste stored in this unit to a disposal facility.

4. The disposal facility must have all necessary Federal and State operating permits.

5. Olin Corporation will ensure that the hazardous waste manifest used is properly filled out and returned to the proper authorities.

Phase II - Decontamination of the Facility

A. After removal of all wastes from the storage tank, the tank will be washed with a neutralizing agent to remove any remaining waste. All cleaning material generated will be tested and if it meets the parameters of the facility MDC discharge permit, it will be processed through the plant's pretreatment facility. If not, the material will be collected and sent off-site to a properly permitted facility. After cleaning, the tanks will be either sold for reuse or salvaged.

B. After removal of the storage tank, the diked area will be hydroblasted to remove any residues accumulated over its operating life. As stated in A above, all water generated will be tested and if it meets the parameters of the facility MDC discharge permit, it will be processed through the plant's pretreatment facility. If not, the material will be collected and sent off-site to a properly permitted facility. Since this unit only contains by-product hydrochloric acid, any incidental material remaining in concrete after cleaning would be neutralized by the concrete itself. Therefore, no testing of the dike walls or base will be necessary.

C. On completion of the decontamination, the unit will be inspected by and the closure will be certified by an independent Massachusetts registered professional engineer and by Olin that the facility has been closed in accordance with the specifications in the Closure Plan.

Olin CHEMICALS

120 LONG RIDGE ROAD, STAMFORD, CONNECTICUT 06904

April 27, 1984

Ms. Nancy Wrenn
Division of Hazardous Waste
DEQE
One Winter Street
Boston, MA 02108

Re: Revised Hazardous Waste Permit Application
Olin Corporation - Wilmington Plant
EPA I.D. No. MAD001403104

Dear Ms. Wrenn:

Please find attached revised Forms 1 and 3 for Olin Corporation's Wilmington, Massachusetts plant. Since the original submission on November 17, 1980, Olin Corporation has submitted two revisions to its RCRA Part A permit application. The first was submitted on January 26, 1983 and in a letter dated March 17, 1983 from the USEPA it was indicated that the amendment had been incorporated into our file. The second amendment was submitted on June 30, 1983 (copy attached) requesting the removal of two 15,000-gallon storage tanks and is currently under review. When the June 30, 1983 request is approved, the facility will have two drum storage units and one storage tank unit remaining at the facility.

The purpose of today's request is to allow for the movement of the storage tank to a diked area meeting the requirements of Mass. 310 CMR 30.694 for secondary containment of above ground storage tanks. Due to space limitations, it is not feasible to upgrade the current containment area to provide for 110% volume of the tank as required in 310 CMR 30.694. Therefore, Olin Corporation requests that its Part A interim status application be revised as provided for in 310 CMR 30.099(a) which allows modification of interim status permits when such modification does not constitute an increase in design capacity.

We wish to also take this opportunity to make some clerical and administrative revisions to our interim status permit. These include:

Form 1, Item X, A - Since the original submission, the plant has been issued an NPDES permit and the number is reflected in this section.

Form 1, Attachment 1, Existing Environmental Permits - This section has been updated to reflect existing permit status.

IV, Line 6, Page 3 of 5 - The designation of storage of this material in SO2, tanks, has been removed. This designation should have been removed when the request to remove the two 15,000-gallon storage tanks was submitted on June 30, 1983. These storage tanks were never used for hazardous waste storage.

Form 3, Item IV, Line 8, Page 3 of 5 - The estimated annual quantity of this material has been changed from 45 tons to 250 tons. The primary uses of this material, by-product HCl, is for use as a feedstock in another production process and neutralization of other waste streams at the facility. On occasions when market demand for products is reduced, some of this material is neutralized and discharged through our MDC-permitted treatment facility. Therefore, the annual amount of this material can vary dramatically.

Form 3, Item V, Page 5 of 5 - The facility drawing has been revised to show the new location of the bulk storage tank.

For your convenience, a complete Form 1 and Form 3 are being submitted to be inserted into our file. This revised application supercedes all previous submissions except to the extent that previous submissions established timely compliance.

We would appreciate your assistance in acting on this revision expeditiously as we are prepared to move the tank to the upgraded containment area upon written approval from your department. As always, your cooperation is appreciated and should you have any questions concerning today's revisions, please do not hesitate to contact Mr. J. W. O'Grady at 615/336-4541.

Sincerely,

OLIN CORPORATION

F. A. Eakin
Vice President
Manufacturing & Engineering

FAE/JWO/vrp

cc: Mr. Jacob Edwards
Date Waste Programs
U. S. Environmental Protection Agency
Room 1903
J.F.K. Federal Building
Boston, Massachusetts 02203

Northeast Region DEQE
323 New Boston Street
Woburn, MA 01801

Please print or type in the unshaded areas only (fill-in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-R0175

FORM 1 GENERAL — EPA — U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program
(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER: F MAD001403104 D

LABEL ITEMS

I. EPA I.D. NUMBER

III. FACILITY NAME

V. FACILITY MAILING ADDRESS

VI. FACILITY LOCATION

PLEASE PLACE LABEL IN THIS SPACE

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill-in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold-faced terms.

SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED
A. Is this facility a publicly owned treatment works which results in a discharge to waters of the U.S.? (FORM 2A)		X		B. Does or will this facility *(either existing or proposed)* include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to waters of the U.S.? (FORM 2B)		X	
C. Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)	X		No	D. Is this a proposed facility *(other than those described in A or B above)* which will result in a discharge to waters of the U.S.? (FORM 2D)		X	
E. Does or will this facility treat, store, or dispose of hazardous wastes? (FORM 3)	X		Yes	F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)	–	X		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
I. Is this facility a proposed stationary source which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X		J. Is this facility a proposed stationary source which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	

III. NAME OF FACILITY

1 SKIP OLIN CORPORATION

IV. FACILITY CONTACT

A. NAME & TITLE (last, first, & title)	B. PHONE (area code & no.)
2 McBRIEN RONALD J. PLANT MGR.	617 933 4240

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX

3 51 EAMES STREET

B. CITY OR TOWN	C. STATE	D. ZIP CODE
4 WILMINGTON	MA	01887

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER

5 51 EAMES STREET

B. COUNTY NAME

MIDDLESEX

C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE (if known)
6 WILMINGTON	MA	01887	

CONTINUE

CONTINUED FROM THE FRONT

VII. SIC CODES (4-digit, in order of priority)

A. FIRST	B. SECOND
7 2869 (specify) Industrial Organic Chemicals	7 (specify) N/A
C. THIRD	D. FOURTH
7 (specify) N/A	7 (specify) N/A

VIII. OPERATOR INFORMATION

A. NAME

8 OLIN CORPORATION

B. Is the name listed in Item VIII-A also the owner? ☒ YES ☐ NO

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)

F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC (other than federal or state)
O = OTHER (specify)

P (specify)

D. PHONE (area code & no.)

A 203 356 2000

E. STREET OR P.O. BOX

120 LONG RIDGE ROAD

F. CITY OR TOWN	G. STATE	H. ZIP CODE
B STAMFORD	CT	06904

IX. INDIAN LAND

Is the facility located on Indian lands? ☐ YES ☒ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water)	D. PSD (Air Emissions from Proposed Sources)
9 N MA0005304	9 P NONE
B. UIC (Underground Injection of Fluids)	E. OTHER (specify)
9 U NONE	9 SEE ATTACHED (specify)
C. RCRA (Hazardous Wastes)	E. OTHER (specify)
9 R INTERIM STATUS	9 (specify)

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property bounderies. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS (provide a brief description)

Manufacturer of chemical blowing agents, antioxidants, stabilizers and other specialty chemicals for the rubber and plastics industry.

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. NAME & OFFICIAL TITLE (type or print)	B. SIGNATURE	C. DATE SIGNED
.A. Eakin, Vice President ..anufacturing and Engineering	ME 4/21/84 JA Eakin	4/30/84

COMMENTS FOR OFFICIAL USE ONLY

C

Revised 4/27/84

Olin Corporation
Wilmington, Massachusetts Plant
MAD001403104

FORM 1 - ATTACHMENT 1 (Revised 4/27/84)

II.C.: Forms 1 and 2C were submitted on May 5, 1982.

II.E.: Original Forms 1 and 3 were submitted on November 17, 1980.

X. Existing Environmental Permits

1. Letter of Approval to Operate Sanitary Landfill dated January 9, 1975.
2. Industrial User Discharge Permit, Metropolitan District Commission, Dated July 7, 1982.
3. Letter of Approval to Construct Gypsum Storage Lagoon No. 1, dated July 16, 1971.
4. Letter of Approval to Construct Gypsum Storage Lagoon No. 2, dated September 10, 1973.
5. Letters of Approval to Construct Bag Collection Systems dated July 12, 1983 and July 18, 1974.
6. Letters of Approval to Construct and Operate an Air Scrubber dated October 20, 1982 and July 28, 1983.

Please print or type in the unshaded areas only (fill-in areas are spaced for elite type, i.e., 12 characters/inch)

Form Approved OMB No. 158-S80004

FORM 3 RCRA

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

HAZARDOUS WASTE PERMIT APPLICATION

Consolidated Permits Program

(This information is required under Section 3005 of RCRA.)

I. EPA I.D. NUMBER

F MAD001403104

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below *(mark one box only)* to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION *(place an "X" below and provide the appropriate date)*

☐ 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

8 | YR. | MO. | DAY | FOR EXISTING FACILITIES, PROVIDE THE DATE (yr., mo., & day) OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

☐ 2. NEW FACILITY *(Complete item below.)*

| YR. | MO. | DAY | FOR NEW FACILITIES, PROVIDE THE DATE (yr., mo., & day) OPERATION BEGAN OR IS EXPECTED TO BEGIN

B. REVISED APPLICATION *(place an "X" below and complete Item I above)*

☒ 1. FACILITY HAS INTERIM STATUS

☐ 2. FACILITY HAS A RCRA PERMIT

III. PROCESSES – CODES AND DESIGN CAPACITIES

A. PROCESS CODE — Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then *describe the process (including its design capacity) in the space provided on the form (Item III-C).*

B. PROCESS DESIGN CAPACITY — For each code entered in column A enter the capacity of the process.
1. AMOUNT — Enter the amount.
2. UNIT OF MEASURE — For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER *(barrel, drum, etc.)*	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER *(Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)*	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G
LITERS	L
CUBIC YARDS	Y
CUBIC METERS	C
GALLONS PER DAY	U
LITERS PER DAY	V
TONS PER HOUR	D
METRIC TONS PER HOUR	W
GALLONS PER HOUR	E
LITERS PER HOUR	H
ACRE-FEET	A
HECTARE-METER	F
ACRES	B
HECTARES	Q

EXAMPLE FOR COMPLETING ITEM III *(shown in line numbers X-1 and X-2 below)*: A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

C | DUP | T/A | C 1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S 0 2	600	G		5				
X-2	T 0 3	20	E		6				
1	S 0 1	17,390	G		7				
2	S 0 2	10,310	G		8				
3					9				
4					10				

Continued from the front.

III. PROCESSES *(continued)*

C. SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESSES *(code "T04")*. FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY.

IV. DESCRIPTION OF HAZARDOUS WASTES

A. EPA HAZARDOUS WASTE NUMBER — Enter the four—digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If you handle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four—digit number*(s)* from 40 CFR, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.

B. ESTIMATED ANNUAL QUANTITY — For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non—listed waste*(s)* that will be handled which possess that characteristic or contaminant.

C. UNIT OF MEASURE — For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:
   For listed hazardous waste: For each listed hazardous waste entered in column A select the code*(s)* from the list of process codes contained in Item III to indicate how the waste will be stored, treated, and/or disposed of at the facility.
   For non—listed hazardous wastes: For each characteristic or toxic contaminant entered in column A, select the code*(s)* from the list of process codes contained in Item III to indicate all the processes that will be used to store, treat, and/or dispose of all the non—listed hazardous wastes that possess that characteristic or toxic contaminant.
   Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code*(s)*.

2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER — Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B,C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

EXAMPLE FOR COMPLETING ITEM IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* — A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non—listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. EPA HAZARD. WASTE NO *(enter code)*	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE *(enter code)*	D. PROCESSES 1. PROCESS CODES *(enter)*	2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
X-1	K 0 5 4	900	P	T 0 3 D 8 0	
X-2	D 0 0 2	400	P	T 0 3 D 8 0	
X-3	D 0 0 1	100	P	T 0 3 D 8 0	
X-4	D 0 0 2				included with above

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1)	FOR OFFICIAL USE ONLY		
W MAD001403104 1	W DUP	2	DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)				D. PROCESSES 2. PROCESS DESCRIPTION (If a code is not entered in D(1))
1	P105	250	P	S01				
2	U028	5000	P	S01				
3	U154	1000	P	S01				
4	D008	9	T	S01				
5	D001	15	T	S01				
6	D001	13	T	S01				
7	U028							Included with above
8	D002	250	T	S02	T01			
9	M001	6700	P	S01				
10								
11								
12								
13								
14								
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16								
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18								
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23								
24								
25								
26								

Continued from the front

IV. DESCRIPTION OF HAZARDOUS WASTES *(continued)*

E. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

EPA I.D. NO. *(enter from page 1)*

													T/A	C
F	M	A	D	0	0	1	4	0	3	1	0	4		6

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail).*

VI. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground—level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail).*

VII. FACILITY GEOGRAPHIC LOCATION

LATITUDE *(degrees, minutes, & seconds)*	LONGITUDE *(degrees, minutes, & seconds)*
42 31 34N	071 09 15W

VIII. FACILITY OWNER

[X] A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. *(area code & no.)*
E	

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE
F	G		

IX. OWNER CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
F.A. Eakin, Vice President Manufacturing and Engineering	MYSS 5/21/84 [signature]	4/30/84

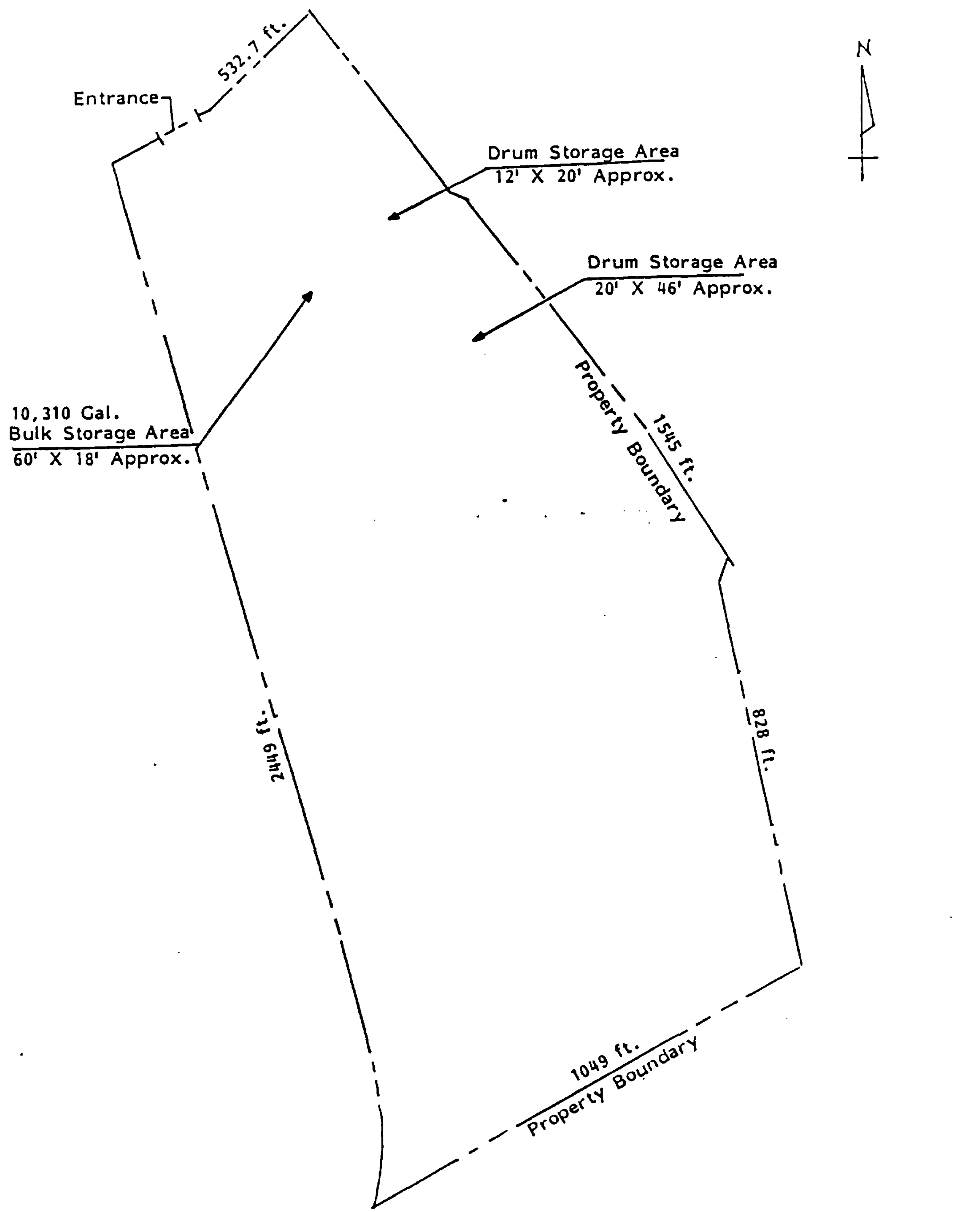
X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED

Continued from page 4

V. FACILITY DRAWING (see page 4)



Olin CHEMICALS GROUP
120 LONG RIDGE ROAD, STAMFORD, CT 06904

WILLIAM A. OPPOLD
Senior Vice President
Manufacturing and Engineering

June 30, 1983

Mr. William Cass, Director
Division of Hazardous Waste
Department of Environmental
Quality Engineering
Commonwealth of Massachusetts
One Winter Street
Boston, MA 02108

Re: Revised Hazardous Waste Permit Application
Olin Corporation-Wilmington Plant
EPA I.D. No. MAD001403104

Dear Mr. Cass:

On November 17, 1980, Olin Corporation submitted a RCRA permit application, (i.e., Forms 1 and 3) for its Wilmington, Massachusetts plant. This original submission was revised on January 26, 1983. Today, we are revising our application in order to remove two 15,000-gallon storage tanks. These tanks were included in our original submission to store RCRA hazardous wastes. However, these tanks were never used for the storage of hazardous wastes and the need to keep these tanks available for hazardous wastes storage no longer exists. Form 3, Part III, A and B, Page 1 of 5, has been revised to delete S02, 30,000 G,. Also on Page 5 of 5, we have removed the 30,000-gallon bulk storage area shown in the northern corner of the property. For convenience, an entire Form 3 is being submitted and should be inserted in our file. This revised application supercedes all previous submissions except to the extent that previous submissions establish timely compliance.

Thank you for your assistance in this matter and if there are any questions concerning the above changes, please contact Mr. J. W. O'Grady at 615/336-4541.

Sincerely,

OLIN CORPORATION

W. A. Oppold

WAO/JWO/vrp HBS 7/6/83

cc: U. S. Environmental Protection Agency
Region I
Permits Branch
P. O. Box 8748
Boston, MA 02114

Please type or print in the unshaded areas only (fill-in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-S80004

FORM 3 RCRA

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

HAZARDOUS WASTE PERMIT APPLICATION

Consolidated Permits Program

(This information is required under Section 3005 of RCRA.)

I. EPA I.D. NUMBER

F | M A D 0 0 1 4 0 3 1 0 4

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below *(mark one box only)* to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION *(place an "X" below and provide the appropriate date)*

☐ 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

☐ 2. NEW FACILITY *(Complete item below.)*

C 8 | YR. | MO. | DAY | FOR EXISTING FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

YR. | MO. | DAY | FOR NEW FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR IS EXPECTED TO BEGIN

B. REVISED APPLICATION *(place an "X" below and complete Item I above)*

☒ 1. FACILITY HAS INTERIM STATUS

☐ 2. FACILITY HAS A RCRA PERMIT

III. PROCESSES – CODES AND DESIGN CAPACITIES

A. PROCESS CODE — Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process *(including its design capacity)* in the space provided on the form *(Item III-C)*.

B. PROCESS DESIGN CAPACITY — For each code entered in column A enter the capacity of the process.
1. AMOUNT — Enter the amount.
2. UNIT OF MEASURE — For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER *(barrel, drum, etc.)*	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER *(Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)*	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G
LITERS	L
CUBIC YARDS	Y
CUBIC METERS	C
GALLONS PER DAY	U
LITERS PER DAY	V
TONS PER HOUR	D
METRIC TONS PER HOUR	W
GALLONS PER HOUR	E
LITERS PER HOUR	H
ACRE-FEET	A
HECTARE-METER	F
ACRES	B
HECTARES	Q

EXAMPLE FOR COMPLETING ITEM III *(shown in line numbers X-1 and X-2 below)*: A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

C | DUP | 1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S 0 2	600	G		5				
X-2	T 0 3	20	E		6				
1	S 0 1	17,290	G		7				
	S 0 2	10,310	G		8				
3					9				
4					10				

Continued from the front.

III. PROCESSES *(continued)*

C. SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESSES *(code "T04")*. FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY.

IV. DESCRIPTION OF HAZARDOUS WASTES

A. EPA HAZARDOUS WASTE NUMBER — Enter the four–digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If you handle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four–digit number*(s)* from 40 CFR, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.

B. ESTIMATED ANNUAL QUANTITY — For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non–listed waste*(s)* that will be handled which possess that characteristic or contaminant.

C. UNIT OF MEASURE — For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:

For listed hazardous waste: For each listed hazardous waste entered in column A select the code*(s)* from the list of process codes contained in Item III to indicate how the waste will be stored, treated, and/or disposed of at the facility.

For non–listed hazardous wastes: For each characteristic or toxic contaminant entered in column A, select the code*(s)* from the list of process codes contained in Item III to indicate all the processes that will be used to store, treat, and/or dispose of all the non–listed hazardous wastes that possess that characteristic or toxic contaminant.

Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code*(s)*.

2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER — Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B,C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

EXAMPLE FOR COMPLETING ITEM IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* — A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non–listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. EPA HAZARD. WASTE NO *(enter code)*	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE *(enter code)*	D. PROCESSES 1. PROCESS CODES *(enter)*	D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
X-1	K 0 5 4	900	P	T 0 3 D 8 0	
X-2	D 0 0 2	400	P	T 0 3 D 8 0	
X-3	D 0 0 1	100	P	T 0 3 D 8 0	
X-4	D 0 0 2				included with above

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1)	T/A	C	FOR OFFICIAL USE ONLY		T/A	C	
W M A D 0 0 1 4 0 3 1 0 4		1	W	DUP		2	DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)				D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	P105	250	P	S01				
2	U028	5000	P	S01				
3	U154	1000	P	S01				
4	D008	9	T	S01				
5	D001	15	T	S01				
6	D001	13	T	S02	S01			
7	U028							Included with above
8	D002	45	T	S02	T01			
9	M001	6700	P	S01				
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

EPA Form 3510-3 (6-80)

CONTINUE ON REVERSE

ntinued from the front

DESCRIPTION OF HAZARDOUS WASTES (continued)

E. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

EPA I.D. NO. (enter from page 1)

M A D 0 0 1 4 0 3 1 0 4 | T/A C: 6

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility (see instructions for more detail).

VI. PHOTOGRAPHS

All existing facilities must include photographs (*aerial or ground—level*) that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas (*see instructions for more detail*).

VII. FACILITY GEOGRAPHIC LOCATION

LATITUDE (degrees, minutes, & seconds)	LONGITUDE (degrees, minutes, & seconds)
42 31 34 N	071 09 15 W

VIII. FACILITY OWNER

[X] A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. (area code & no.)

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE
	G		

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME (print or type)	B. SIGNATURE	C. DATE SIGNED
W. A. Oppold, Sr. Vice President Manufacturing and Engineering		7/14/83

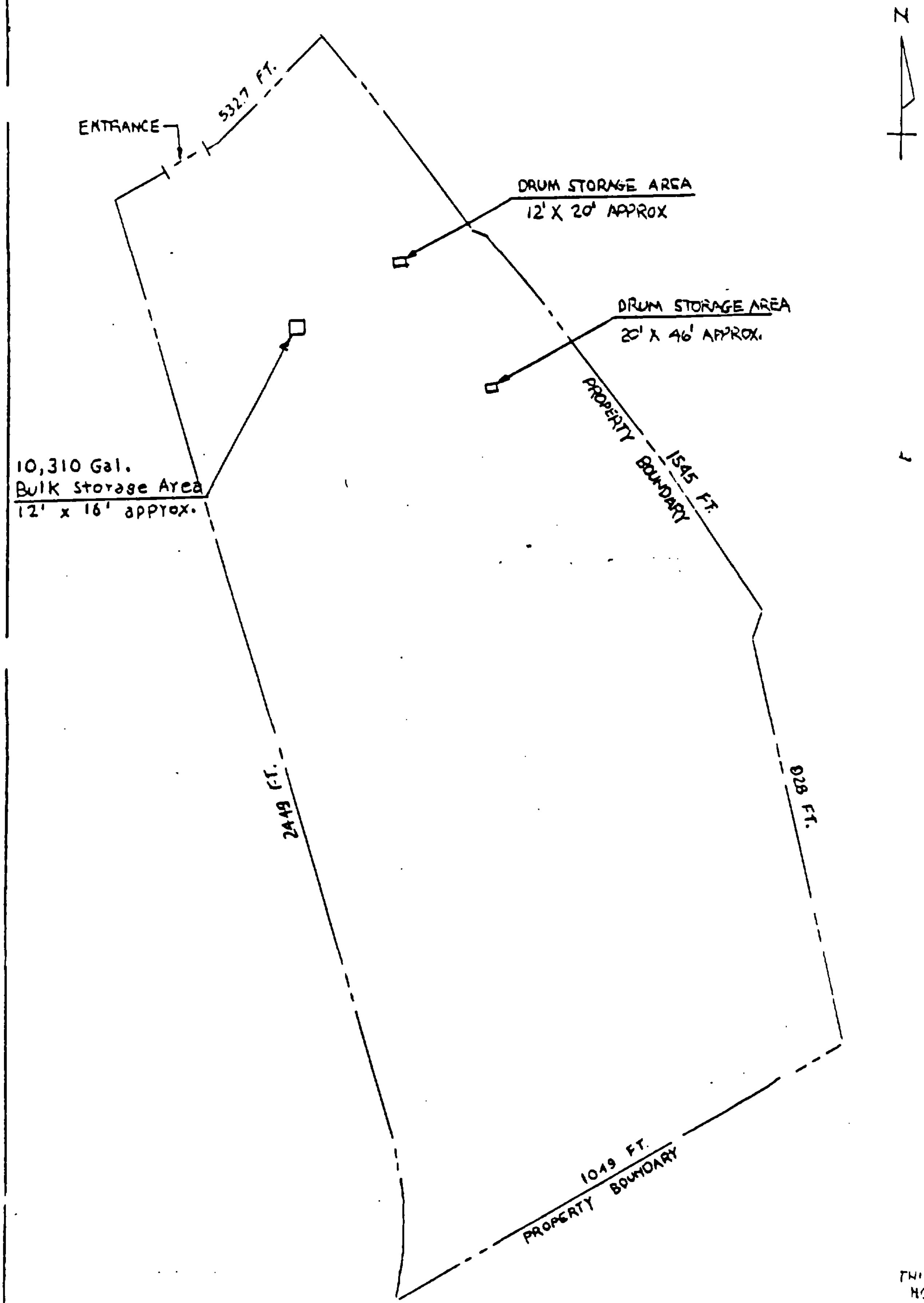
X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME (print or type)	B. SIGNATURE	C. DATE SIGNED

Continued from page 4

V. FACILITY DRAWING (see page 4)



THIS DRAWING IS NOT TO SCALE

AMMONIUM HYDROXIDE TANKS

QUESTION 1:

SWMU: Ammonium Hydroxide Tanks

b) Type of Unit: Storage Tanks

Dimensions: 15,000/15,100/8,000/10,000-gallon, all carbon steel, all diked

Information on how unit was designed, constructed, operated and maintained:

1) 15,000 gallon - Plant B tank farm, diked

2) 15,100 gallon - West of Plant C-3, out-of-service and removed

3) 8,000 gallon - Plant D tank farm, diked

4) 10,000 gallon - Treatment plant, diked

c) Date in use: 1) 1983 to present
2) Unknown to 12/83
3) 2/84 to 7/86
4) 9/82 to present

d) [redacted] from Kempore process stored prior to being neutralized and discharged to POTW.

e) Releases of hazardous wastes or hazardous constituents: None known

f) Information, data and documentation concerning any releases: None

g) Corrective actions: None required

WASTEWATER TREATMENT SYSTEM

QUESTION 1:

SWMU: Wastewater Treatment Plant

b) Type of Unit: Treatment/Neutralization/Settling

Dimensions: System utilized 7 tanks, 1 sump and 2 settling ponds to treat process wastewater prior to discharge to POTW

Information on how unit was designed, constructed, operated and maintained: Acid stream is treated with lime and sent to one of two lagoons to allow settling of calcium sulfate sludge. Supernatant returned to clarifier and discharged to POTW. Other process streams are neutralized using HCl or ammonium hydroxide, then sent to the clarifier and discharged to POTW.

c) Date in use: 1971-current

d) Quantity and Type(s) of wastes managed in unit: Average flow 250,000 gpd, typical composition sulfates 800-1200 ppm, chlorides 350-3500, trace organics, low levels zinc, copper, cyanide. Note: Plant ceased chemical processing July 1, 1986.

e) Releases of hazardous wastes or hazardous constituents: None known, discharge to POTW.

f) Information, data and documentation concerning any releases: Unknown

g) Corrective actions: None required

QUESTION 1:

SWMU: Lagoons I and II

b) Type of Unit: Settling Pond

Dimensions: I) 195 ft. x 195 ft. x 11 ft.
II) Top 245 x 130 x 10 ft.

Information on how unit was designed, constructed, operated and maintained: Originally lined with a PVC liner in 1972. Lagoon was relined in 1981 and built to the dimensions listed above. The pond was constructed on a 1 foot layer of compacted sand, lined with a 36 mil Hypalon® liner, covered with 1 foot of compacted sandy-clay and this in turn was covered by 1 foot of 3/4" to 1½" processed gravel. Acidic (sulfuric) wastewater was lime neutralized in the treatment plant tank and discharged to lagoon for settling of calcium sulfate sludge. Supernatant was returned to the clarifier for discharge to the POTW.

c) Date in use: First put in service 1972-73

d) Quantity and Type(s) of wastes managed in unit: When Kempore process running sulfuric acid wastewater (0.05 mgd) from azodicarbonamide process treated with lime (0.02 mgd) and discharged into lagoon.

e) Releases of hazardous wastes or hazardous constituents: There have been no known releases of hazardous waste or hazardous constituents from this unit (for additional information see below).

f) Information, data and documentation concerning any releases: A four-season hydrogeologic study (see attached Hydrogeologic Investigation, Malcolm Pirnie, Inc., Appendix C) of the groundwater and the surface waters was conducted at the Wilmington plant site during 1981. The results of the study indicated that the lagoons were believed to be leaking and were potential sources of inorganic chemicals.

g) Corrective actions: Lagoons were relined in 1981 and 1983, respectively.

For more detailed information pertaining to the design, construction, operation, maintenance or regarding any possible releases prior to Olin's acquisition on September 15, 1980, please contact Stepan Chemical Company, Inc., Edens and Winnetka Roads, Winnetka, Illinois 60093-0000, (312) 446-7500.

PLANT-B PIT.

QUESTION 1:

SWMU: Plant B Pit

b) Type of Unit: Settling Tank

Dimensions: 7 ft. x 14 ft. x 11.5 ft.

Information on how unit was designed, constructed, operated and maintained: Covered concrete tank. Bottom and top 8" thick and walls 10" thick.

c) Date in use: Actual dates put in service and process utilization unknown. Existence discovered after Olin acquisition. Contents cleaned out and disposed of offsite in March 1986.

d) Quantity and Type(s) of wastes managed in unit: See attached analysis of disposal contents

e) Releases of hazardous wastes or hazardous constituents: Unknown

f) Information, data and documentation concerning any releases: Unknown

g) Corrective actions: Contents removed and tank filled with concrete

For more detailed information pertaining to the design, construction, operation, maintenance or regarding any possible releases prior to Olin's acquisition on September 15, 1980, please contact Stepan Chemical Company, Inc., Edens and Winnetka Roads, Winnetka, Illinois 60093-0000, (312) 446-7500.

Plant [illegible]

E.C.JORDAN CO.

CONSULTING ENGINEERS
562 CONGRESS STREET PO BOX 7050 • PORTLAND MAINE 04112
(207) 775-5401 TELEX 94-4329

REPORT OF ANALYSIS
REFERENCE NUMBER 434
DATE 8/22/83
PAGE 1

OLIN CHEMICAL
ATTN: JIM MARTUCCI
51 EAMES STREET
WILMINGTON MA 01887

CLIENT LAB ID	DATE RECEIVED / PARAMETER		UNITS		RESULTS
BOTTOM	7/01/83				
3182020	PH (LABORATORY)				5.
	PHENOLICS, TOTAL RECOVERABLE		MG/KG		69
	SEMI-VOLATILE BASE/NEUTRALS				
	N-NITROSODIPHENYLAMINE		MG/KG		430
	BIS(2-ETHYLHEXYL)PHTHALATE		MG/KG		36000
	EP EXTRACTION-ARSENIC		MG/L		0.00
	EP EXTRACTION-BARIUM		MG/L		0.3
	EP EXTRACTION-CADMIUM		MG/L		0.02
	EP EXTRACTION-CHROMIUM		MG/L		0.02
	EP EXTRACTION-LEAD		MG/L		0.07
	EP EXTRACTION-MERCURY		UG/L	<	
	EP EXTRACTION-SELENIUM		MG/L	<	0.00
	EP EXTRACTION-SILVER		MG/L		0.00
	FLASH POINT		DEGREES F	>	20
	BRITISH THERMAL UNITS	6A	LBS.		958
TOP	7/01/83				
3182021	PH (LABORATORY)				5.
	PHENOLICS, TOTAL RECOVERABLE		MG/KG		11
	SEMI-VOLATILE BASE/NEUTRALS				
	N-NITROSODIPHENYLAMINE		MG/KG		200
	BIS(2-ETHYLHEXYL)PHTHALATE		MG/KG		10000
	EP EXTRACTION-ARSENIC		MG/L		0.00
	EP EXTRACTION-BARIUM		MG/L		0.1
	EP EXTRACTION-CADMIUM		MG/L		0.00
	EP EXTRACTION-CHROMIUM		MG/L		0.02
	EP EXTRACTION-LEAD		MG/L		0.0[illegible]
	EP EXTRACTION-MERCURY		MG/L	<	
	EP EXTRACTION-SELENIUM		MG/L	<	0.01
	EP EXTRACTION-SILVER		MG/L	<	0.01
	FLASH POINT		DEGREES F	>	21
	BRITISH THERMAL UNITS	6A	LBS		[illegible]

SIGNATURE William J Karp

REPORT TO ROBERT M BURGER
AUTHORIZATION 420700

ORIGINAL

CALCIUM SULFATE LANDFILL

QUESTION 1:

SWMU: Calcium Sulfate Landfill

b) Type of Unit: Landfill

Dimensions:

Information on how unit was designed, constructed, operated and maintained: See attached plan for most recent utilization (1985) and design.

c) Date in use: January 1975-1986

d) Quantity and Type(s) of wastes managed in unit: Calcium sulfate sludge and water from Lagoon I and II cleanouts. See attached for EP extract analyses. Estimate volume since 1975 75,000 cubic yards.

e) Releases of hazardous wastes or hazardous constituents: There have been no known releases of hazardous wastes or hazardous constituents from this unit

f) Information, data and documentation concerning any releases: Unknown

g) Corrective actions: Unknown

For more detailed information pertaining to the design, construction, operation, maintenance or regarding any possible releases prior to Olin's acquisition on September 15, 1980, please contact Stepan Chemical Company, Inc., Edens and Winnetka Roads, Winnetka, Illinois 60093-0000, (312) 446-7500.

Stepan Chemicals – Special Leachates

Sludge is non-hazardous

SLUDGE TYPE	RUN(R) AND COMPOSITE(C) NUMBER	DATE SAMPLE COLLECTED	INITIAL SLUDGE PPM Hg	TRACE METALS IN LEACHATE - PPM Hg	Ag	Ba	As	Cu	Ni	Pb	Cr	Tl	Zn	Se	Cd	Sb
EPA limit				.2	5	100	5	—	—	5	5	—	—	1	1	—
Special leachate	R1-C1	5.5.80	.0587	.0007	.001	1.25	<.02			.3	.019			<.02	.03	
"	R2-C1	"	.069	Reanalysis: .0007 .003	.001	1.25	<.02			.15	.013					
														<.02	.023	
"	R3-C1	"	5.27	Reanalysis: .001 .003	.001	1.0	<.02			.225	.038					
														<.02	.038	
"	R4-C1	"	.0502	Reanalysis: <.0002 .003	.001	1.0	<.02			.09	.031					
														<.02	.035	

PESTICIDES – IN LEACHATE – PPM

			ENDRIN	LINDANE	METHOXYCHLOR	TOXAPHENE	2-4,D	2,4,5-TP SILVEX
EPA Limit			.02	.4	10	.5	10	1.0
Special leachate	R1-C1	"	<.0001	<.0001	<.0001	<.0004	<.01	<.005
"	R2-C1	"	<.0001	<.0001	<.0001	<.0004	<.01	<.005
"	R3-C1	"	<.0001	<.0001	<.0001	<.0004	<.01	<.005
"	R4-C1	"	<.0001	<.0001	<.0001	<.0004	<.01	<.005

RECEIVED
AUG - 5 1985
J. W. O'GRADY

Olin CHEMICALS GROUP

81 EAMES STREET, WILMINGTON, MA 01887

July 30, 1985

Mr. Vartkes Karaian
Chief of Solid Waste
Department of Environmental Quality Engineering
5 Commonwealth Avenue
Woburn, Massachusetts 01801

Dear Mr. Karaian:

As discussed in a phone conversation with Mr. Jack O'Grady on July 23, 1985, Olin plans to remove the calcium sulfate in lagoon #1 and place it in our calcium sulfate landfill located at the Wilmington Plant. The calcium sulfate will be placed within the original boundaries of the landfill.

Four drawings are provided in appendices A through D. Appendix A shows the original outline of the landfill boundary. Appendix B provides the outline and elevation of the existing completed section of the landfill. Appendix C is a blow up of the completed portion and surrounding area. Appendix D details the maximum boundaries after the lagoon #1 cleanout is completed. The final completed area is difficult to determine but it will be within the boundary as defined in Appendix D. The actual completed area should be mainly concentrated at the Northwestern corner of the landfill.

The plan of work is as follows:

1. The calcium will be trucked to the landfill and placed within a soil berm.
2. All calcium sulfate will be grated to the maximum elevation of 101 feet.
3. The top of the landfill will be covered with 18" of compacted claylike soil.
4. The claylike layer will be covered with 6 inches of topsoil and seeded.
5. A finish grade of 2% slope minimum will be provided for the top of the landfill.
6. The working face of the landfill will be covered with 6" of claylike soil.
7. The claylike layer will be covered with 6" of topsoil and seeded.
8. The landfill will be surveyed after completion of the covering of this section and the drawing will be revised to show the existing grade.

We would like to start the cleanout in August with completion of the covering this year. If you have any questions or wish to visit the site. Please contact Jim Martucci at (617) 933-4240.

Sincerely,

Ronald J. McBrien

Ronald J. McBrien
Plant Manager

JFM

RJM/jt

APPENDIX A

SITE PLAN

[illegible] DEWATERED [illegible] LANDFILL

NATIONAL POLYCHEMICALS Inc

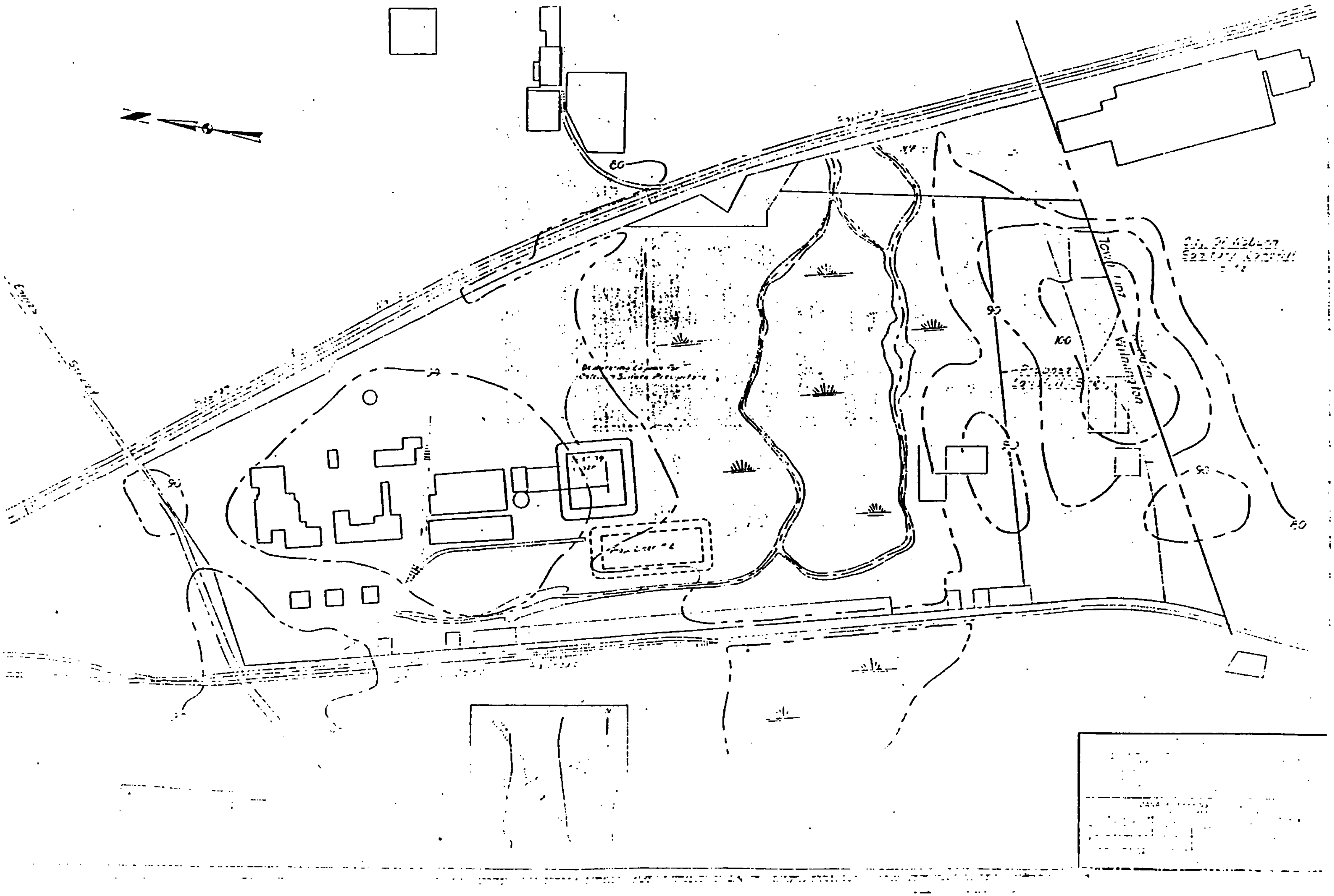
[illegible]STON MASS.

DANA F. PERKINS and SONS, INC.
Civil - Sanitary Engineers and Land Surveyors
Reading — Lowell Massachusetts

Drawn:	Ch'k'd:	App'd:	Designed:
[illegible]	[illegible]	[illegible]	John M. [illegible] Jr.

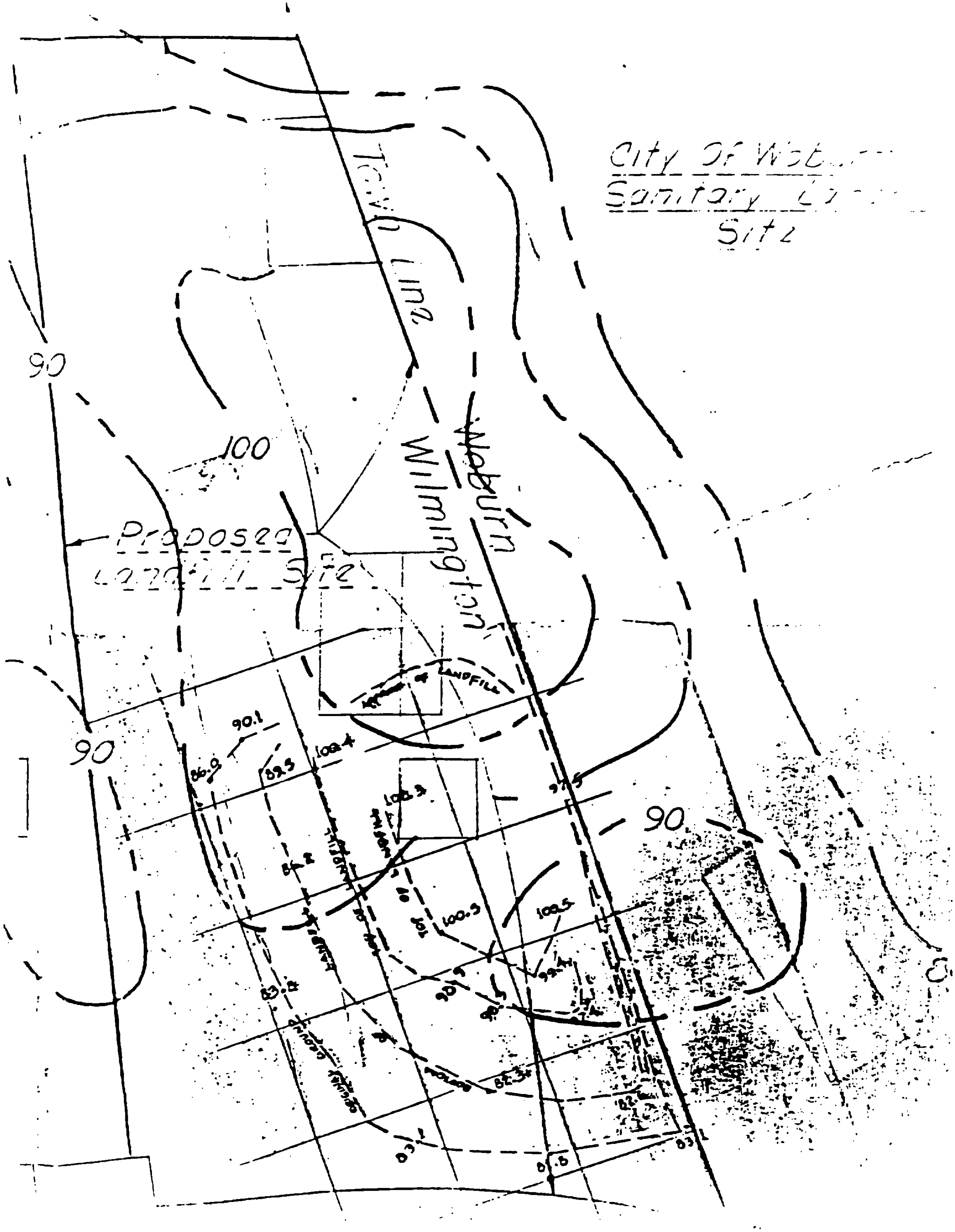
Date	Surveyor - Engineer:
[illegible]	

Div:	Scale:	Calc'd:	File / Dwg. No.
			S-21355B



80
90
100
Town Line
Wilmington

APPENDIX B



City Of Wob...
Sanitary ...
Site
Town Line
Woburn
Wilmington
Proposed
Landfill Site
90
100
90
90
90.1
86.9
82.5
100.4
100.3
97.5
100.5
100.5
83.4
82.3
82.6
83

INTERCEPTOR WELL SYSTEM

QUESTION 1:

SWMU: Interceptor Well System

b) Type of Unit: Groundwater interception, storage and treatment

Dimension: Four wells approximately 20 ft. deep pumping 1-2 gpm each to 15,000-gallon separation tank and skimmer, water carbon treated prior to in-plant usage.

Information on how unit was designed, constructed, operated and maintained: See attached reports

c) Date in use: 1981 to present

d) Quantity and Type(s) of wastes managed in unit: Water contains approximately 1-2 mg/l Bis(2-ethylhexyl)phthalate and 1-2 mg/l N-Nitrosodiphenylamine. Other trace organics including diisobutylene and di-n-octylphthelate may be present.

e) Releases of hazardous wastes or hazardous constituents: None known

f) Information, data and documentation concerning any releases: None

g) Corrective actions: System was installed as a corrective action for seep along east side of property believed to have emanated from Plant B tank farm and vicinity.

Olin CHEMICALS GROUP
51 EAMES STREET, WILMINGTON, MA 01887

OCT 0 1985

September 26, 1985

Mr. Thomas F. McMahon, Director
Division of Water Polution Control
The Commonwealth of Massachusetts
1 Winter Street
Boston, Massachusetts 02108

RE: OLIN CORPORATION
Wilmington Massachusetts
Interceptor Well System Monthly Status Report

Dear Mr. McMahon:

Since modifying the Interceptor Well System on October 22, 1984. The system has operated quite effectively with the exception of some minor problems with the lines plugging or freezing.

As indicated in the attached table, the new system has provided continuous and effective drawdown on the ground-water table. Furthermore, the visible seepage along the East ditch has been eliminated. We will continue to monitor the operation of the system and make observations of the East ditch.

As discussed with Peter Dore, we will continue to keep you informed of the operation of the system, with periodic status reports. Should you have any questions concerning the operation of the Interceptor Well System. Please contact James F. Martucci at (617) 933-4240.

Sincerely,

OLIN CORPORATION

Ronald J. McBrien

Ronald J. McBrien
Plant Manager JFM

Attachement
CC: Peter Dore

RJM/jt

Date	IW-6 (89.03 top)	IW-7 (90.17 top)	IW-8 (89.97 top)	IW-9 (89.77 top)	JOE (89.73 top)	JOF (89.20 top)	JOD (89.95 top)
3/1/85	70.20	68.50	68.47	77.44*	76.06 (dry)	77.53 (dry)	76.28 (dry)
3/7/85	70.70	68.34	71.30	68.60	76.06 (dry)	77.53 (dry)	76.28 (dry)
3/13/85	69.61	68.84	69.97	68.60	77.06	77.53 (dry)	77.45
3/20/85	69.86	68.67	72.05	79.77*	79.53	77.86	79.95
3/28/85	69.03	68.59	71.97	68.10	77.40	79.20	77.53
4/5/85	69.03	68.50	71.89	68.19	77.23	78.03	77.62
4/11/85	68.86	68.33	71.97	68.10	77.31	78.03	77.62
4/19/85	69.53	68.17	71.97	67.94	77.23	78.20	77.53
4/26/85	70.03	68.50	82.30*	68.28	78.56	77.53	77.62
5/3/85	70.03	68.33	72.80	68.44	78.73	77.37	79.95
5/10/85	70.20	68.84	69.30	68.44	77.15	77.53	77.45
5/15/85	70.11	70.84	68.97	68.27	77.23	77.70	77.53
5/23/85	70.03	70.17	69.14	68.44	77.40	77.87	77.62
5/31/85	71.03	68.67	77.30*	68.77	77.23	77.53	77.28
6/7/85	70.03	68.67	75.30*	68.28	77.40	77.53	77.45
7/25/85	70.03	68.50	77.30*	79.77*	77.81	77.53	77.45
8/14/85	70.28	69.00	70.30	78.10*	77.73	78.12	77.95

* - Line Plugged

NOTE: Level of water in the ditch is 77.50'

JEM, jt
9/26/85

TO Jack C.

Olin CHEMICALS GROUP

51 EAMES STREET, WILMINGTON, MA 01887

RECEIVED
OCT 1984
J. W. MCGRADY

October 23, 1984

Mr. Thomas C. McMahon, Director
Division of Water Pollution
Control
The Commonwealth of Massachusetts
1 Winter Street
Boston, Massachusetts 02108

RE: OLIN CORPORATION
Wilmington, Massachusetts
Interceptor Well System Monthly Status Report

Dear Mr. McMahon:

In Olin's Interceptor Well System Status Report dated July 20, 1984, it was indicated that we were in the process of modifying the system. The main reason for the modification was to install a pumping system that would provide greater mechanical reliability. The report indicated that the modifications would be completed by August 31, 1984. This was accomplished.

The purpose of this letter is to report the status of the system's operation since August 31, 1984. The system has operated effectively since installation, with the exception of start up problems experienced with the pump installed in IW-9. The problem encountered with the IW-9 pump was caused by improper installation not equipment failure and therefore is not expected to reoccur.

As indicated in the attached table, the new system has provided continuous and effective drawdown of the groundwater table. Furthermore, the visible seepage along the east ditch has been eliminated. We will continue to monitor the operation of the system and make observations of the east ditch.

Mr. Thomas C. McMahon, Director
October 23, 1984

As discussed with Mr. Peter Dore, we will continue to keep you informed of the operation of the system with periodic status reports. Should you have any questions concerning the operation of the interceptor well system, please contact James F. Martucci at (617)933-4240.

Sincerely,

OLIN CORPORATION

Ronald J. McBrien

Ronald J. McBrien
Plant Manager JFM

Attachment
cc: Mr. Peter Dore

JFM/rlg

DATE	IW-6 (89.03 top)	IW-7 (90.17 top)	IW-8 (89.97 top)	IW-9 (89.77 top)	JOE (89.73)	JOF (89.20)	JOD (89.95)
8/31	New peristaltic pumps operational						
9/4	70.11	68.71	68.22	68.35	76.81	77.53(dry)	77.03
9/10	70.03	68.34	68.51	77.52*	77.65	78.26	77.95
9/17	70.24	68.75	68.30	77.77*	76.19	77.74	77.53
9/24	70.03	73.50	72.47	68.60	76.15	77.53(dry)	76.95(dry)
10/3	70.11	70.00	69.80	71.60	76.15	77.53(dry)	76.95(dry)
10/9	70.19	69.00	68.72	68.60	76.06	77.53(dry)	76.95(dry)
10/15	70.19	68.92	68.64	70.10	76.23	77.53(dry)	77.12

* Pump down for repairs, IW-9 pump back in operation 9/19

NOTE: Level of water in the ditch ~77.50'

JFM/rlg
10-23-84

Olin CHEMICALS GROUP
51 EAMES STREET, WILMINGTON, MA 01887

RECEIVED
JUL 2 . 1984
J. W. O'GRADY

July 20, 1984

Mr. Thomas C. McMahon, Director
Division of Water Pollution Control
The Commonwelath of Massachusetts
1 Winter Street
Boston, MA 02108

RE: Olin Corporation
Wilmington, Massachusetts
Interceptor Well Systems Status Report

Dear Mr. McMahon:

Pursuant to your request dated June 26, 1984, this letter serves as a status report on the interceptor well system as modified. Appendix A contains certified engineering drawings of the system as installed in November, 1983. Appendix B contains groundwater drawdown and isopleths showing operations of the system as installed. Appendix C is a design and data sheet on a Waukesha SP-25® peristaltic type pump that has been field tested at the plant since June 21, 1984.

The attachments show the system as installed has provided the necessary drawdown to intercept and remove the organics located within the area. The systems effectiveness has been adversely affected by continuing problems with fines causing the submersible pumps to become plugged. Various modifications/actions have been taken in order to alleviate this pluggage problem. These include purchasing of an alternative type submersible pump with a screen, redeveloping of IW-8, and raising the pumps off the bottom of the wells. None of these actions however, have totally eliminated the pluggage problems. In June, 1984 after conducting an extensive literature search, we began field testing of a Waukesha SP-25® peristaltic type pump. This pump was selected because of its ability to supply a good flow rate without mechanical contact with the material being pumped. This will alleviate the problems with fines and the extensive maintenance time required on the submersible pumps.

Field testing of this pump has shown that is has the ability to drawdown well IW-8 below 69 feet MSL, and IW-9 below 72 feet MSL. These wells were selected because IW-8 has historically shown the greatest volume of fine material, and IW-9 has routinely had high groundwater levels. Utilization of these pumps will allow continued pumpdown of the interceptor wells and eliminate the erratic operation previously experienced. Initially, these pumps will be installed in interceptor wells #6, 7, 8, and 9. It is estimated that these pumps will be operational by August 31, 1984.

Therefore upon installation of these new pumps, we expect to be able to establish the necessary drawdown on a continuous basis. The data in Appendix B shows that the current system has been able to achieve drawdown. This new system, with greater mechanical reliability, should enhance operation of the system to provide for the continued recovery of the organics within the affected area and elimination of seepage along the east ditch.

Should you have any questions concerning installation and/or operation of the interceptor well system, please do not hesitate to contact Mr. Jack W. O'Grady at (615)336-4541 or Mr. James F. Martucci at (617)933-4240.

Sincerely,

OLIN CORPORATION

Ronald J. McBrien

Ronald J. McBrien
Plant Manager

Attachments
RJM/JWO/rlg

APPENDIX A

CERTIFIED DRAWINGS INTERCEPTOR WELL SYSTEM

D-C122-100	Interceptor well system for Plant B Tank Farm - Proc's flow, Sheet 1
D-C122-100	Interceptor well system for Plant B Tank Farm - Proc's flow, Sheet 2
D-C122-200	Interceptor well system equipment Layout site plan

INTERCEPTOR WELL SYSTEM STATUS

Drawing No. D-C122-200 in Appendix A shows the interceptor well and monitoring well locations included in this report. Wells IW-6, 7, 8, and 9 were installed during November, 1983. Existing monitoring well 2-A has been renumbered IW-5, and has been pumped periodically. Monitoring wells JO-4 and JO-5 have been changed to JOD and JOE. Additionally, since the modified system was installed in November, 1983, an additional monitoring well JOF has been installed between JOD and JOE.

Figure 1 shows a conceptual drawing for operation of the interceptor well system. The pumping wells are utilized to lower the groundwater table beneath the site, thereby gathering contaminated groundwater and reversing the groundwater gradient to the adjoining ditch. With continued pumping, a cone of depression will form around the pumps large enough to encompass the ditch. When this occurs, the water in the drainage ditch will be flowing towards the interceptor wells and seepage to the ditch will cease. The organics which float on top of the water will gather in the center of the cones of depression where the wells will in turn intercept material for recovery. Ideally, the contours of the water table should look like those as shown in Figure 4, over that of the natural groundwater table shown in Figure 2. A recent groundwater table plot is shown in Figure 3. This plot shows the cone of depression encompassing the entire area and intercepting all groundwater flowing beneath the storage tanks, but not extending out to the drainage ditch. One reason for this is the time necessary to develop a good cone of depression. Considerable volumes of water exist beneath the plant site and the soil has a high permeability. These two factors will require several months of pumping before a sufficient cone of depression can be formed. Consistent pumpage is where problems in the field have interferred with full development of the cone of depression.

Tables I through IV contain water level measurement data taken since December 19, 1983 for interceptor wells 6 through 9. As shown on these tables, the wells have had the following average readings:

IW-6	71.9 ft. MSL
IW-7	72.3 ft. MSL
IW-8	75.1 ft. MSL
IW-9	77.5 ft. MSL

A comparison of these values to background readings in monitoring wells GW-13 and 14, which averaged 79.0 feet MSL, show that on the average the interceptor well system has dropped the groundwater table 4.7 feet. The level of water in the ditch is usually a consistent 77.5 feet MSL. The monitoring wells located along the bank (JOD, JOF and JOE) have approached and occassionally have been below this level (see Figure 5). However, we have not been able to consistently maintain a level below the creek (and eliminate the seepage) due to pumpage problems. We believe the new peristaltic pumps will allow us to fully develop the cone of depression.

Although each interceptor well has experienced some groundwater level fluctuations, IW-8 and IW-9 have had historically higher groundwater elevations. IW-8 has experienced problems with fines and as well as high levels of iron formation on the impellers (analysis of the material found of the impellers on 5/8/84 showed 6.7% iron present, the other material on the impellers appeared to be clay/silt. To a lesser degree, this iron formation has also occured in IW-6 and IW-7). IW-9's main pumpdown problem seems to be that it is receiving a greater groundwater volume than that found in the other wells and more than the submersible pump can handle. Due to the problems experienced with submersible pumps at the plant site, a heavy duty above ground peristaltic pump was field tested at the plant commencing June 21, 1984. This pump (see Appendix D) was able to pump IW-8 down to 68.6 feet MSL and IW-9 down to 74.7 feet MSL. This pump demonstrated the ability to alleviate all problems experienced with the interceptor well system to date. Those being:

1) Can pump solids or pump dry without clogging or overheating.

2) Does not require priming.

3) No contact, other than with an easibly replaceable hose, with material being pumped.

4) Above ground location provides easy access and observation as well as maintenance.

One of these pumps will be installed in each interceptor wells IW-6, 7, 8 and 9. These pumps have shown the ability to provide the necessary drawdown as well as provide the necessary consistency in order for a proper cone of depression to form within the operating area. This should occur within one to two months of installation. These pumps should be operational on or about August 31, 1984.

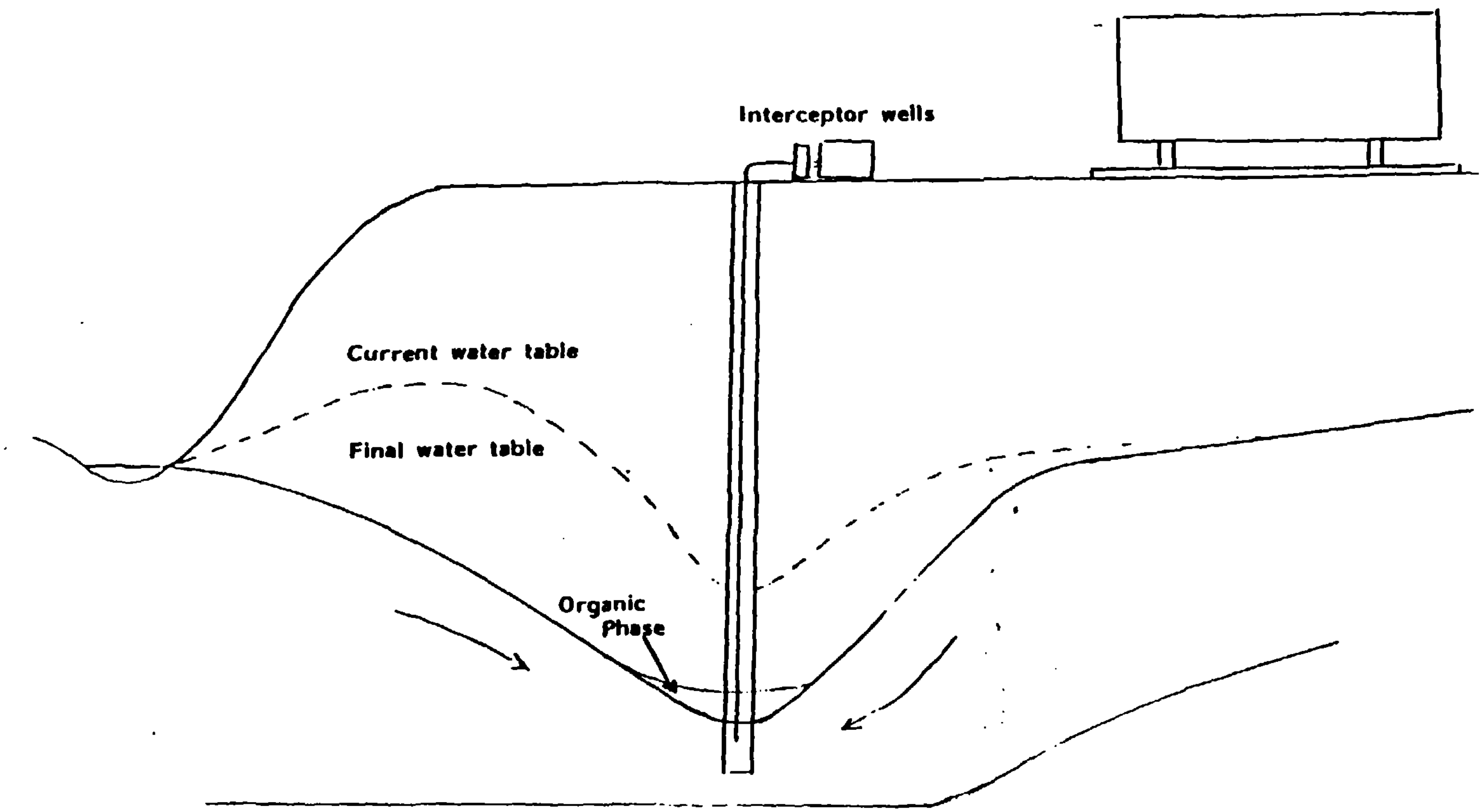


Figure 1: Concept On How Interceptor System Is Planned.

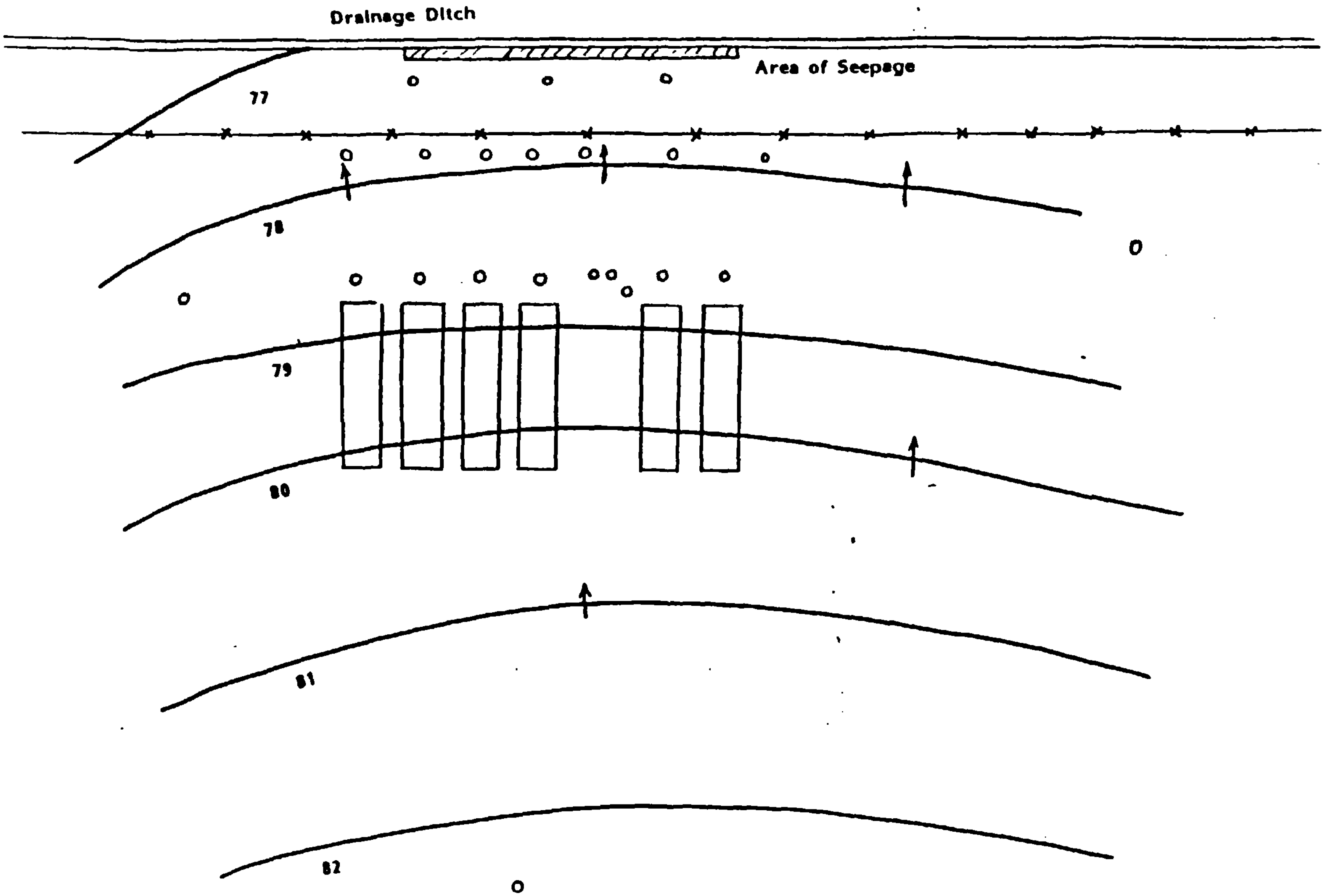


Figure 2 : Water Table Contours Without Pumpage

May 17, 1984

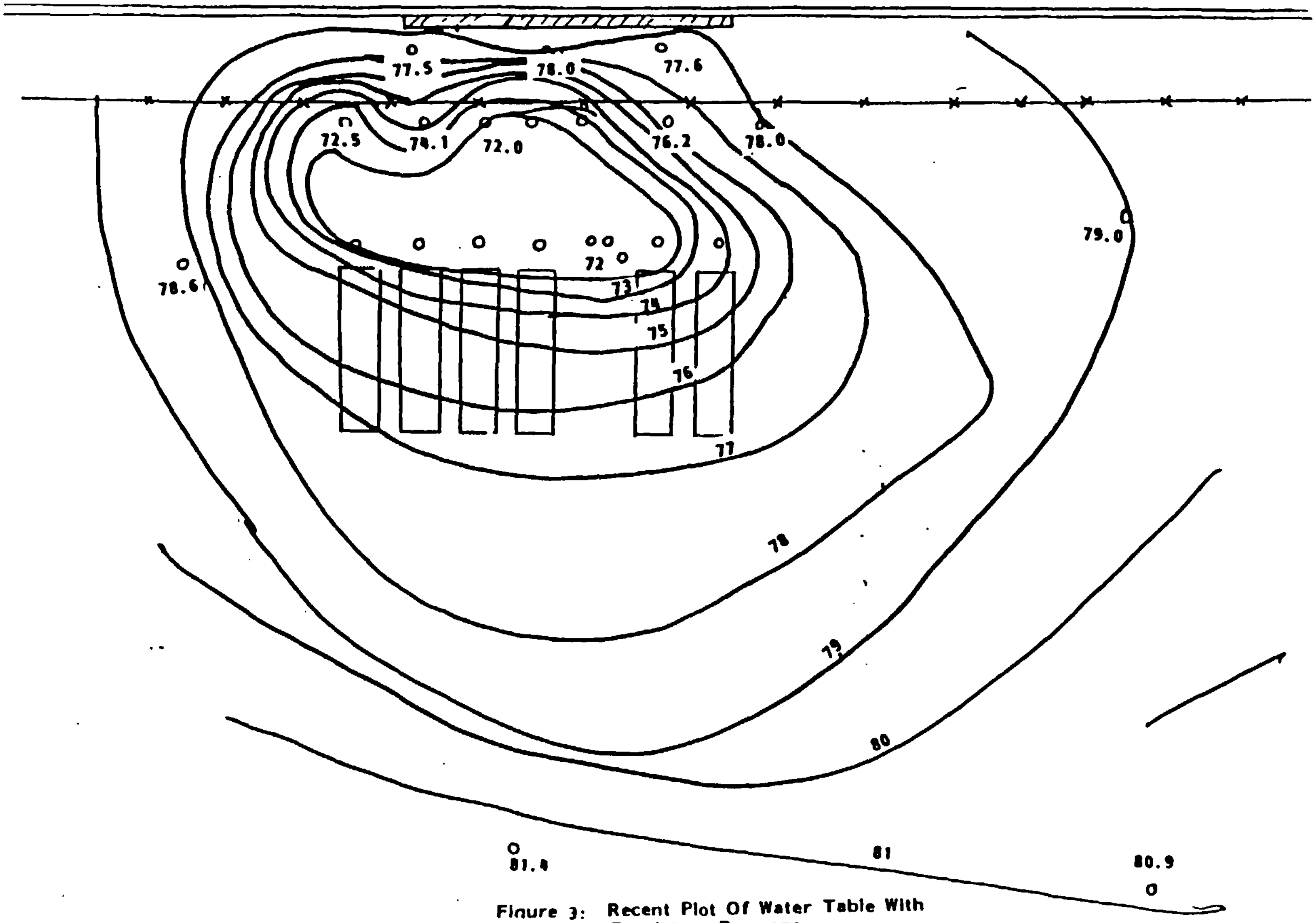


Figure 3: Recent Plot Of Water Table With Consistant Pumpage

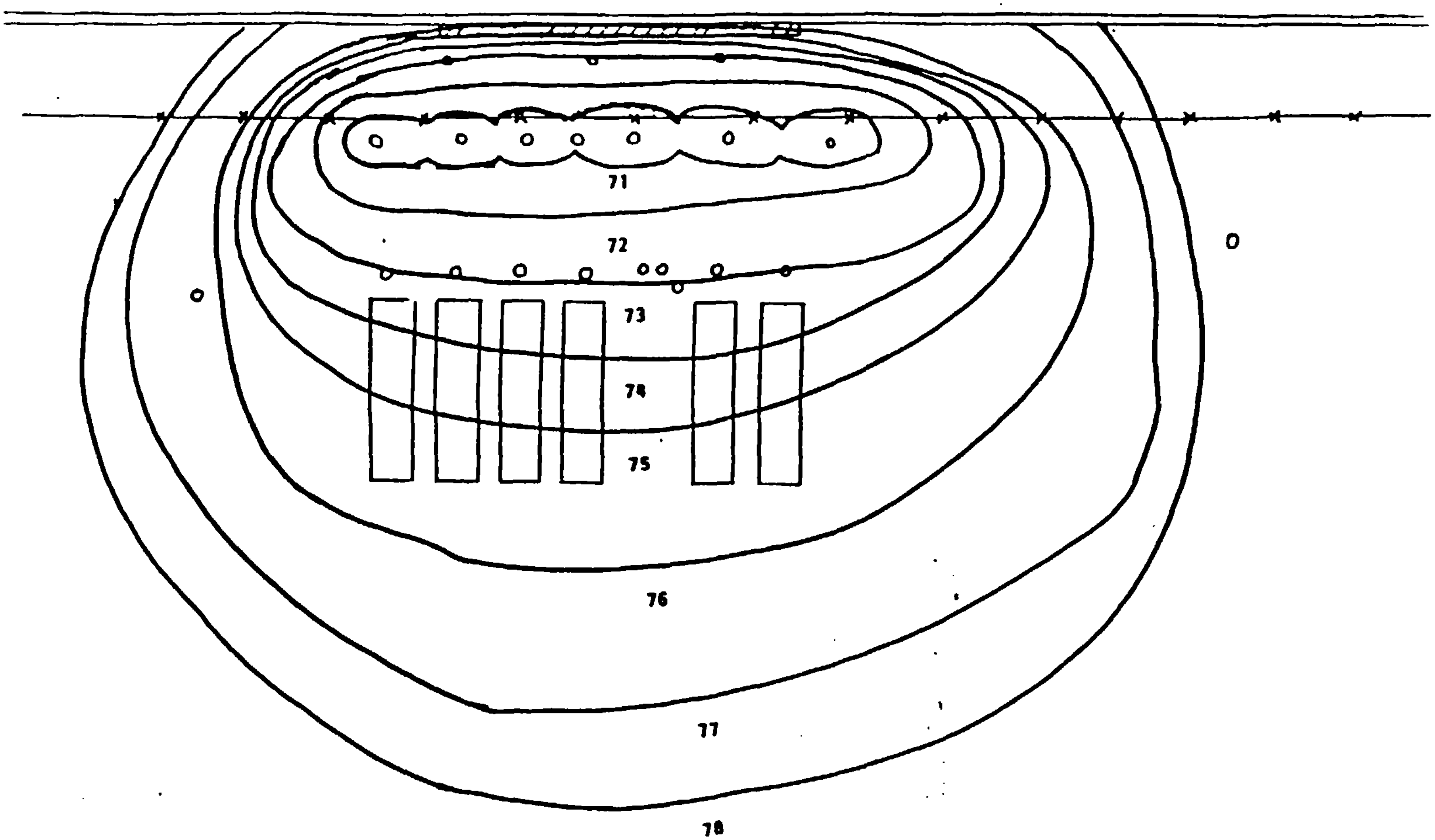


Figure 4 : Idealized Contour Plot of Water Table When All Interceptor Wells Are Pumping

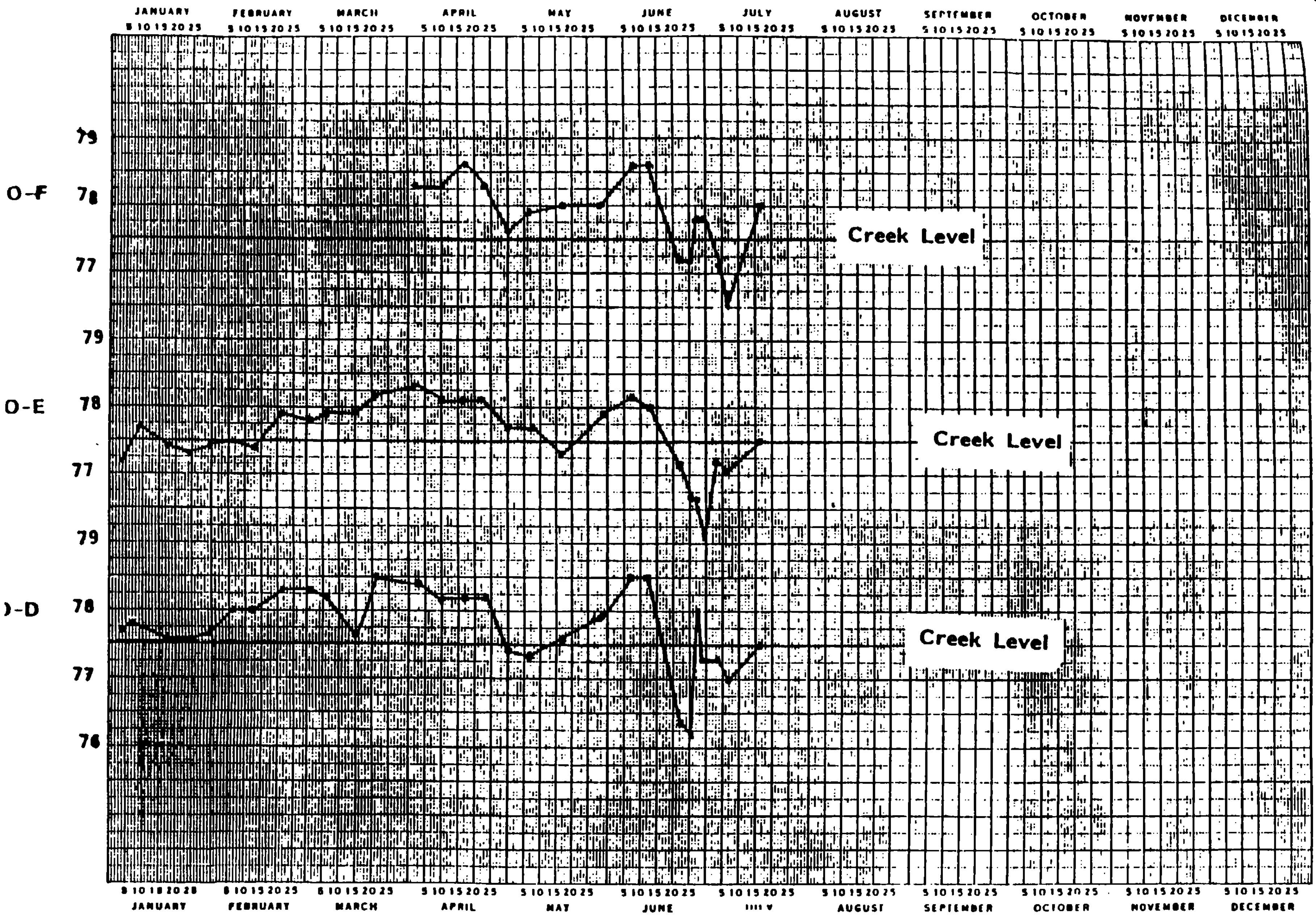


Figure 5: Weekly Plot Of Water Levels Of Monitoring Wells Along The Bank Showing Trend Towards Lower Levels

TABLE I
WELL IW-6 GROUNDWATER ELEVATIONS
PIPE TOP ELEVATION
89.03 ft. MSL

Date	Ft. MSL
12/19/83	71.5
12/28/83	70.0
1/04/84	69.5
1/09/84	70.0
1/17/84	Not measured
1/24/84	69.7
1/30/84	69.5
2/06/84	69.7
2/13/84	69.5
2/21/84	69.5
3/01/84	69.5
3/06/84	69.7
3/15/84	69.8
3/21/84	69.5
4/02/84	76.8
4/10/84	77.3
4/17/84	77.2
4/23/84	78.4
4/30/84	73.7
5/07/84	72.5
5/17/84	72.5
5/29/84	71.9
6/08/84	72.4
6/12/84	74.3
Average	71.9

TABLE II
WELL IW-8 GROUNDWATER ELEVATIONS
PIPE TOP ELEVATION
90.17 ft. MSL

Date		Ft. MSL
12/19/83		71.0
12/28/83		71.2
1/04/84		72.7
1/09/84		78.0
1/17/84		Pump inhibiting measurement
1/24/84		Pump inhibiting measurement
1/30/84		70.2
2/06/84		70.2
2/13/84		71.6
2/21/84		72.5
3/01/84		71.0
3/06/84		72.2
3/15/84		72.2
3/21/84		73.0
4/02/84		75.6
4/10/84		70.5
4/17/84		69.4
4/23/84		70.3
4/30/84		71.4
5/07/84		71.1
5/17/84		74.7
5/29/84		74.2
6/08/84		74.3
6/12/84		73.5
	Average	72.3

TABLE III
WELL IW-8 GROUNDWATER ELEVATIONS
PIPE TOP ELEVATION
89.97 Ft. MSL

Date		Ft. MSL
12/19/83		78.1
12/28/83		76.7
1/04/84		77.8
1/09/84		77.5
1/17/84		Well down for redevelopment
1/24/84		Well down for redevelopment
1/30/84		77.6
2/06/84		73.6
3/13/84		72.3
2/21/84		72.5
3/01/84		73.5
3/06/84		75.4
3/15/84		68.2
3/21/84		74.8
4/02/84		78.6
4/10/84		70.7
4/17/84		73.9
4/23/84		72.0
4/30/84		77.2
5/07/84		77.3
5/17/84		72.0
5/29/84		76.8
6/08/84		77.0
6/12/84		78.0
	Average	75.1

TABLE IV
WELL IW-9 GROUNDWATER ELEVATIONS
PIPE TOP ELEVATION
89.77 Ft. MSL

Date		Ft. MSL
12/19/83		76.3
12/28/83		78.2
1/04/84		76.3
1/19/84		76.6
1/17/84		79.9
1/24/84		77.2
1/30/84		77.5
2/06/84		77.7
2/13/84		78.0
2/21/84		78.5
3/01/84		78.6
3/06/84		78.3
3/15/84		78.7
3/21/84		78.6
4/02/84		78.6
4/10/84		78.4
4/17/84		78.4
4/23/84		78.4
4/30/84		70.5
5/07/84		75.7
5/17/84		76.2
5/29/84		76.8
6/08/84		78.6
6/12/84		78.6
	Average	77.5

JWO/wsr
09/7/19/84

APPENDIX C

WAUKESHA SP/25® PUMP

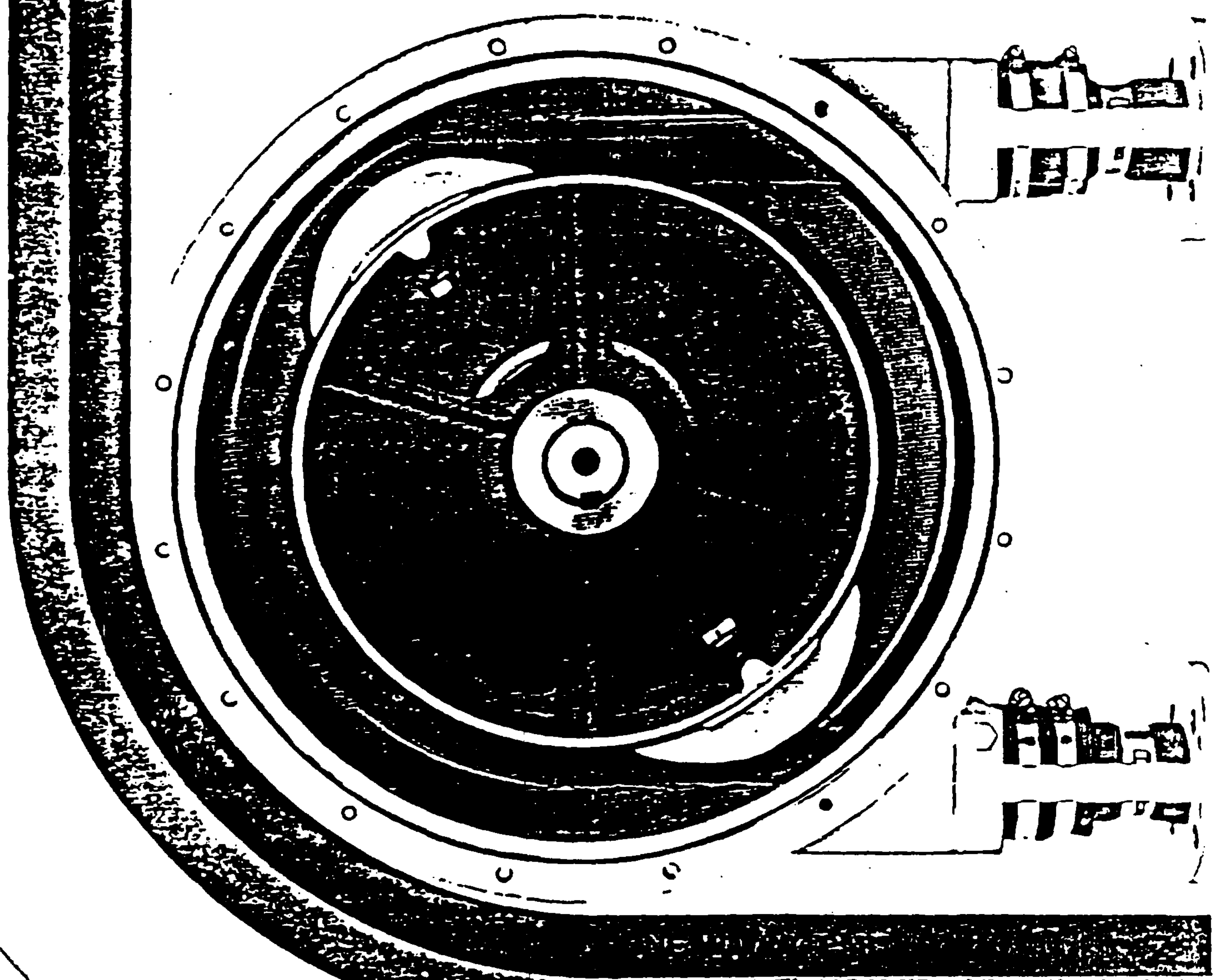
PERISTALTIC TYPE

HOSEPUMP

A NEW PUMP ALTERNATIVE FOR TOUGH APPLICATIONS

. . . including abrasive slurries

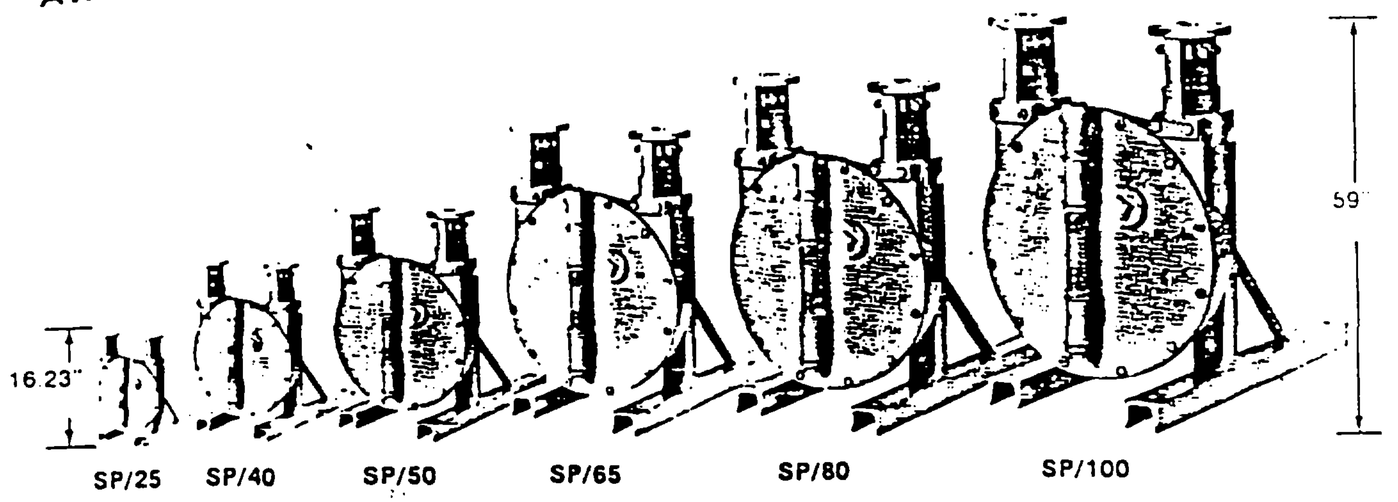
. . . shear-sensitive fluids



- HIGH CAPACITIES
- NO PRODUCT SEALS
- SELF-PRIMING
- HIGH PRESSURES

Distributed In North & South America Exclusively By - WAUKESHA

AVAILABLE IN SIX SIZES



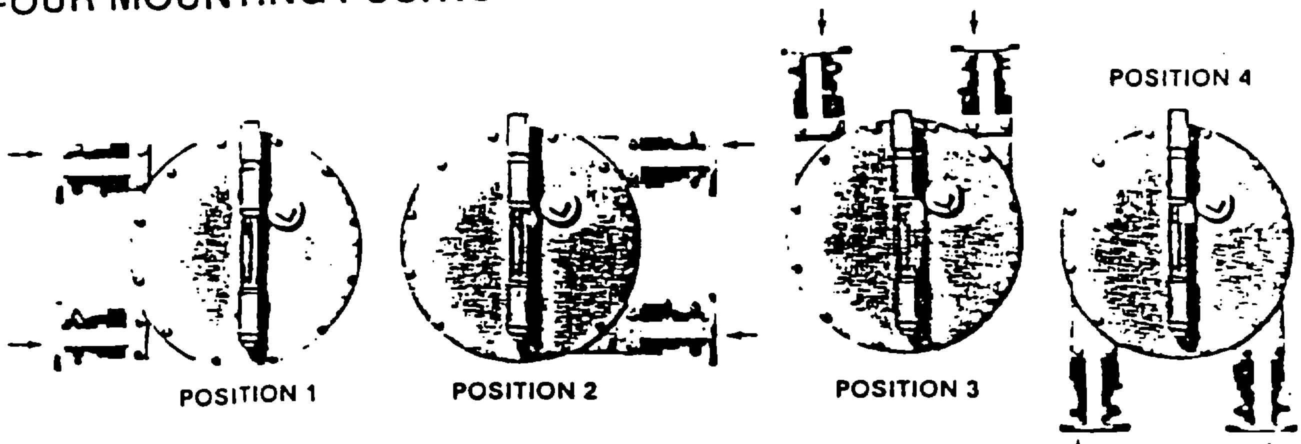
COMPARE THESE FEATURES AGAINST THE PUMP YOU ARE NOW USING:

- Handles abrasive slurries & corrosive acids with minimum wear
- No product seals in contact with material being pumped
- Smooth liquid passage without valves, dead corners or glands to impede flow or cleaning
- High pressure performance to 220 PSIG
- Six pump sizes with flow characteristics of 1 through 330 GPM . . . 1" through 4" I.D. hose sizes
- Completely self-priming (28 to 30 ft. lift)
- Runs dry without detrimental effect . . . can *function as vacuum pump*
- High volumetric efficiency with metering capability . . . output flow is directly proportional to speed at either low or high discharge pressure conditions — including high viscosity slurries
- Low noise level operation — rotating part runs in sealed lubricant bath
- Assembly and servicing with simple tools — with no critical clearance adjustments . . . easy hose *replacement*

PARTIAL LIST OF HOSEPUMP APPLICATIONS

Silicone	Corrosive chemicals & acids	Crystal slurries
Highly abrasive filter coatings	Printing inks	Waste water sludges
Metallic-filled explosives paste	Ore concentrates	Paper slurries
High-solids clay in water	Ceramic slip	Tape oxides
Glue & adhesives	Caulking compounds	Lapping compounds
Shear-sensitive latex suspension emulsions	Potato waste	Drillers mud
Resins with abrasive fillers	Lime & cement mortar	Stringy material in fluids

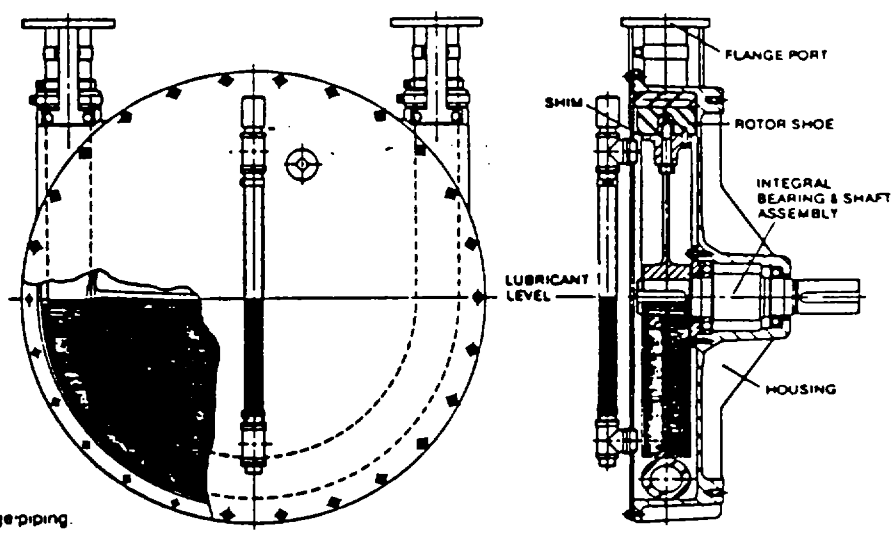
FOUR MOUNTING POSITIONS — CHOICE OF ROTATION



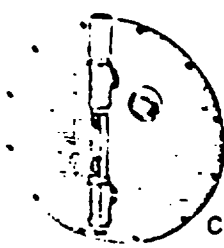
PRINCIPLE OF OPERATION

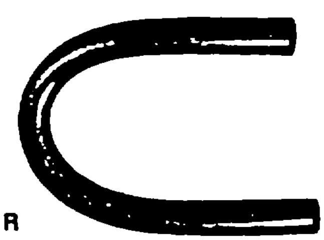
The pumping action of the Hosepump results from alternately compressing and relaxing* the specially designed resilient hose. These front and side view illustrations show how the patented steel reinforced hose is compressed between the inner wall of the housing and the compression shoes on the rotor. A liquid lubricant in the housing minimizes sliding friction. The fluid being pumped is in contact only with the inner wall of the hose. During compression, abrasive particles in the fluid are cushioned in the thick inner hose wall — returning to the fluid stream after compression. The pump has no seals or valves.

* The resultant pulsating flow ' undesirable. may be minimized with an accumulator in the discharge piping.

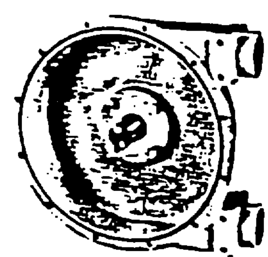


WAUKESHA/Bredel HOSEPUMP COMPONENTS


CO/ER


HOSE*


ROTOR


HOUSING

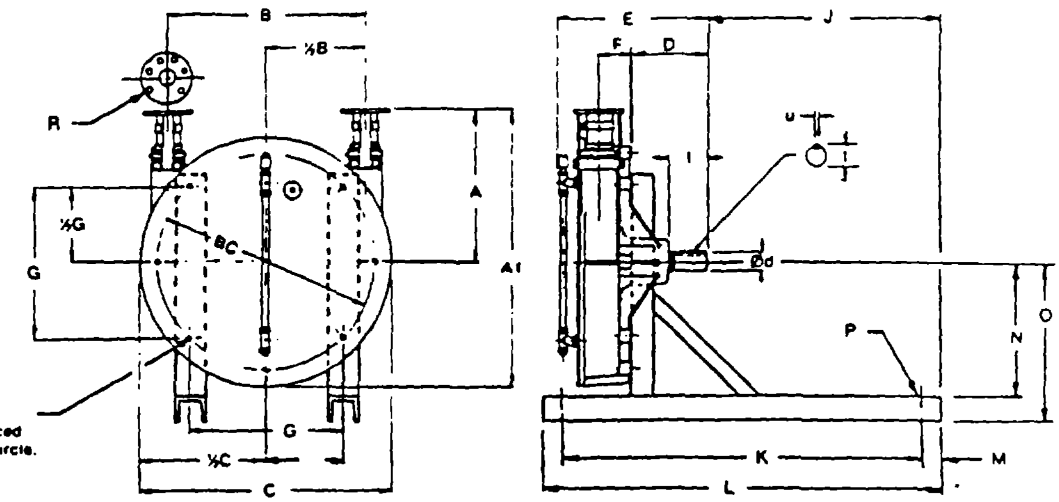
*The patented ho is made of a specially developed thickwall elastomer rubber einforced with nylon cord.

Available materials are
* Natural rubber
* Buna NBR

Hose life ranges from 1,000 - 5,000 working hours, depending upon speed and pressures. A chemical compatibility table for the two hose types is included in this catalog

DIMENSIONS

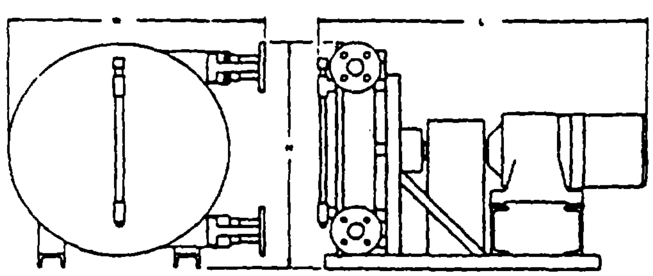
MODEL	DISP /REV	R SIZE	R ASA	WT LBS
SP/25	.088 G / .333 L	1	150	165
SP/40	.35 G / 1.33 L	1 1/2	150	346
SP/50	.76 G / 2.88 L	2	150	536
SP/65	1.75 G / 6.62 L	2 1/2	150	973
SP/80	3.08 G / 11.7 L	3	150	1516
SP/100	5.25 G / 19.9 L	4	150	1800



MODEL	DIM	A	A1	B	C	D	F	G	H	n x T	J	K	L	M	N	O	P	d	I	u	t
SP/25	inch	12 1/16	19 5/16	10 13/32	14 21/32	4 27/32	2 23/32	8 21/32	10 5/8	4×M10	13 1/16	21 21/32	23 5/8	1	7 3/8	8 7/8	9/16	1.182	2 3/8	.315	1.30
	mm	307	490	264	372	123	69	220	270		332	550	600	25	187	225	14	30	60	8	33
SP/40	inch	15 3/4	27 1/8	16 15/16	22 7/8	6 27/32	3 3/8	13 13/32	16 1/2	8×M12	15 25/32	27 9/16	29 17/32	1	11 1/32	12 25/32	23/32	1.576	3 1/[illegible]	.472	1.654
	mm	400	689	430	580	174	85	340	419		401	700	750	25	280	325	18	40	80	12	42
SP/50	inch	19 1/16	33 1/4	21 7/8	28 3/8	8 25/32	4 1/32	17 11/32	20 7/16	8×M12	18 5/8	34 1/4	36 7/32	1	13 31/32	15 3/4	23/32	1.97	3 15/16	.552	[illegible]
	mm	484	845	556	720	223	102	440	519		482	870	920	25	355	400	18	50	100	14	53.5
SP/65	inch	25 1/2	43 15/16	29 13/32	37 7/16	10 29/32	4 27/32	22 27/32	26 3/4	8×M16	25 5/16	43 5/16	45 9/32	1	18 11/16	20 21/32	23/32	2.758	5 1/8	.788	2.935
	mm	648	1116	748	950	277	123	580	679		643	1100	1150	25	475	525	18	70	130	20	74.5
SP/80	inch	28 1/16	49 11/16	34 1/2	43 17/32	11 3/4	4 19/32	22 7/16	24 13/16	8×M20	26 21/32	43 9/32	49 7/32	2	22 1/16	27 9/16	7/8	3.152	5 29/32	.867	3.349
	mm	713	1262	876	1105	298	142	570	570		677	1150	1250	50	560	700	22	80	150	22	85
SP/100	inch	32 11/16	58 3/16	41 1/32	51 7/32	15 11/16	6 27/32	26 3/4	26 3/4	8×M24	33 17/32	58 1/16	62	2	25 3/16	32 9/32	1 1/32	3.94	7 7/8	1.103	4.175
	mm	830	1478	1042	1300	398	174	679	679		852	1475	1575	50	640	820	26	100	200	28	106

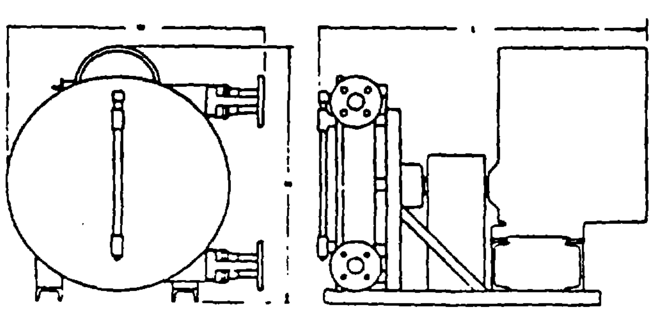
TYPICAL DRIVE ARRANGEMENTS

FIXED SPEED UNITS



MODEL	INCHES / MILLIMETERS	L	W	H
SP/25	inch	37-1/2	19-1/2	16-5/16
	mm	952.5	495	414.3
SP/40	inch	45-1/8	28	24-1/4
	mm	1148	710	615
SP/50	inch	40-7/8	33-7/16	29-7/8
	mm	1548	850	760
SP/65	inch	61-7/8	42 5/16	39
	mm	1573	1075	990
SP/80	inch	73-7/8	50	48-3/4
	mm	1876	1270	1238
SP/100	inch	85-7/8	58 11/16	57-3/16
	mm	2181	1490	1452

VARIABLE SPEED UNITS



MODEL	INCHES / MILLIMETERS	L	W	H
SP/25	inch	39-5/8	19 1/2	23 5/16
	mm	1008	495	592
SP/40	inch	51-5/16	28	32 1/16
	mm	1300	710	814
SP/50	inch	64-3/4	33 7/16	40-3/16
	mm	1644	850	1021
SP/65	inch	73-1/2	42 5/16	51 1/2
	mm	1866	1075	1306
SP/80	inch	84-3/8	50	57 1/16
	mm	2143	1270	1449
SP/100	inch	90-1/4	58 11/16	61 3/4
	mm	2290	1490	1570

Dimensions subject to change without notice.

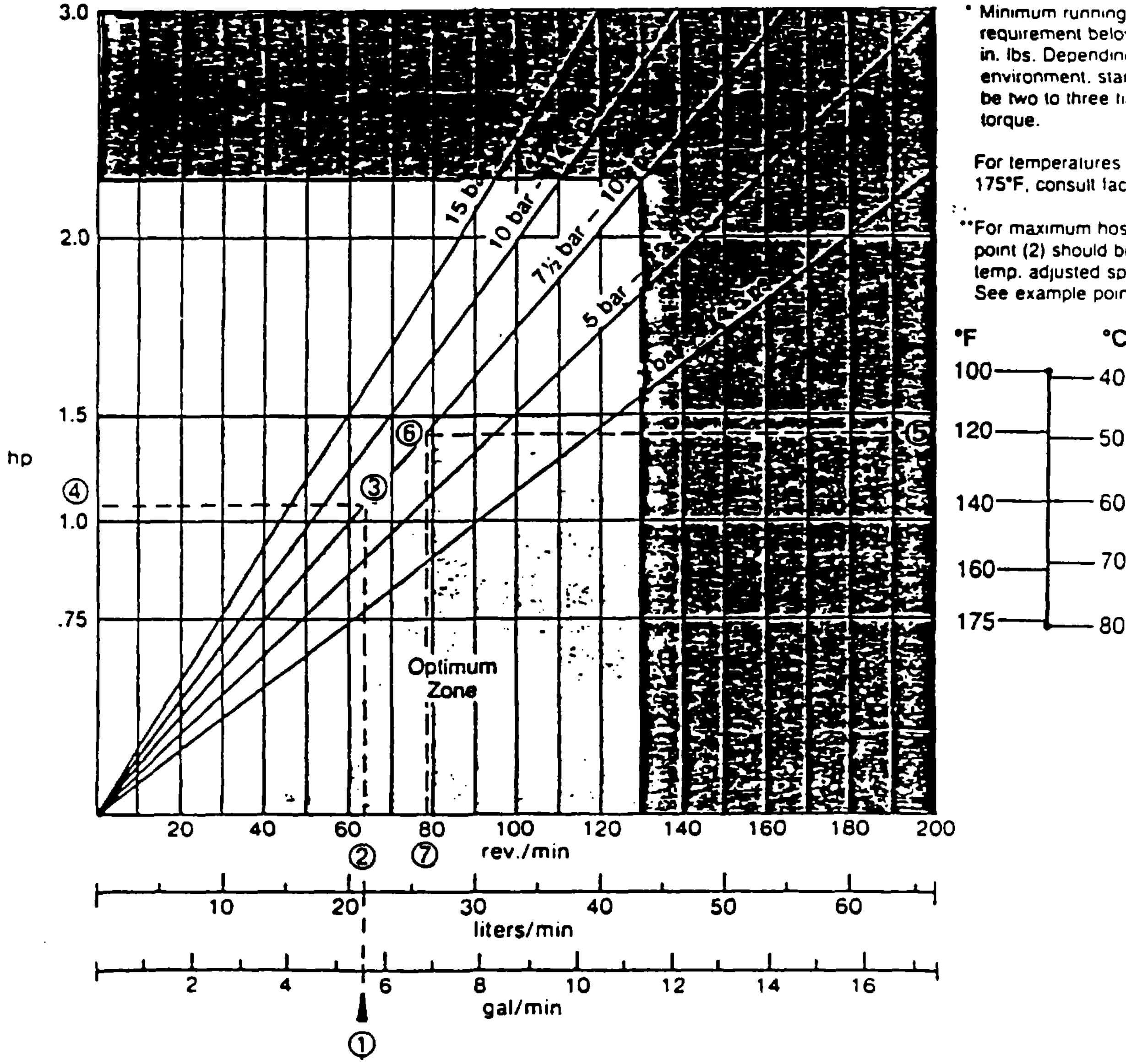
PERFORMANCE CHART

How To Calculate Speed/Horsepower

1. Flow Required
2. Required Speed
3. Calculated Pressure
4. Horsepower Required
5. Fluid Temperature
6. Calculated Pressure
7. Max. Recommended R P M **

TYPE SP/25

PORTS ASA - 150# 1" Displacement per rev. .088 gal./.333 liter
PUMPHOSE INNER DIAMETER .985 Inch (25mm)



NOTES:

* Minimum running drive torque requirement below this hp is 700 in. lbs. Depending on operating environment, starting torque can be two to three times running torque.

For temperatures higher than 175°F, consult factory.

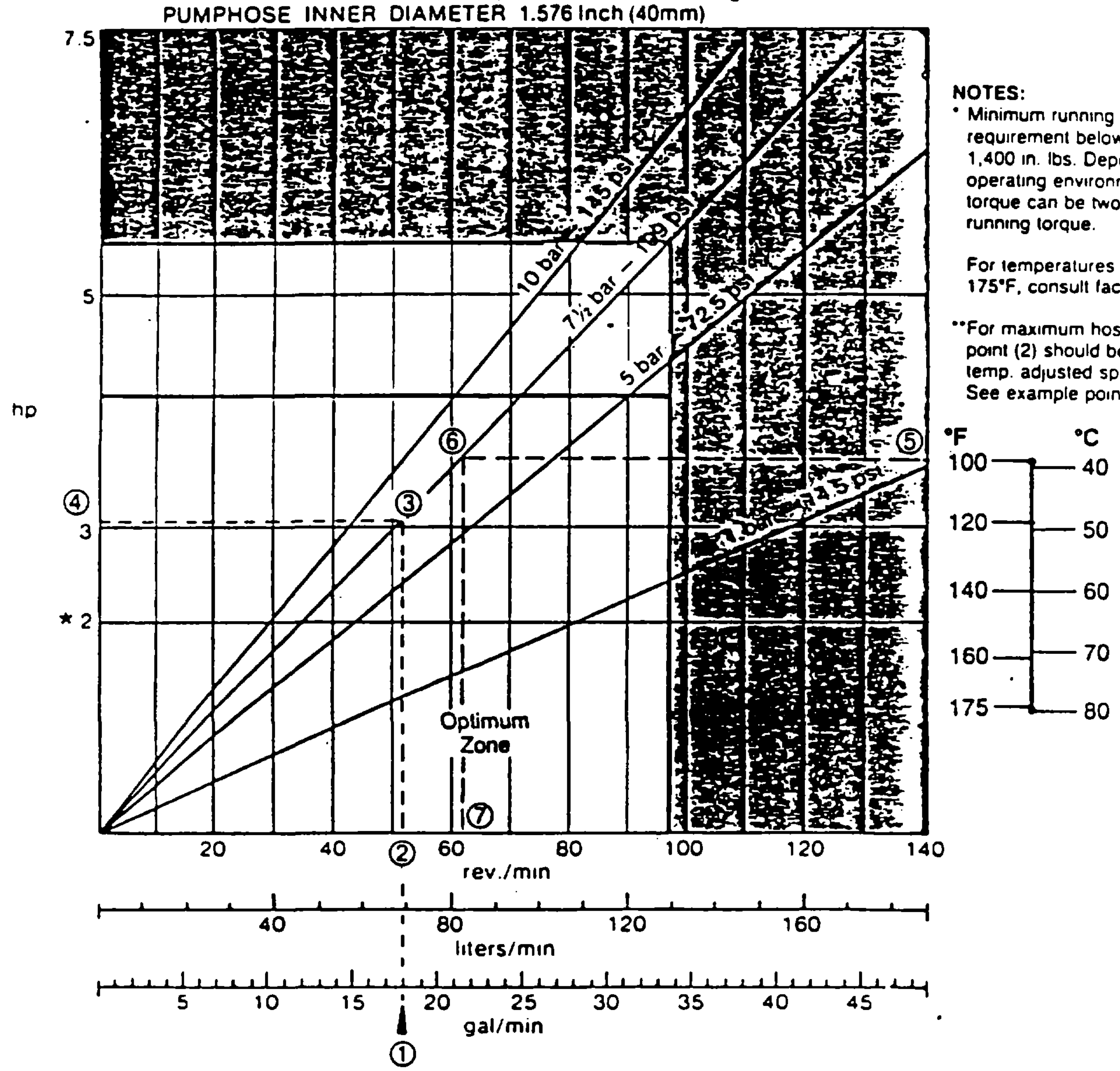
**For maximum hose life, speed point (2) should be lower than temp. adjusted speed point (7) See example points (1) thru (7)

PERFORMANCE CHART

How To Calculate Speed/Horsepower
① Flow Required
② Required Speed
③ Calculated Pressure
④ Horsepower Required
⑤ Fluid Temperature
⑥ Calculated Pressure
⑦ Max Recommended R P M **

TYPE SP/40

PORTS ASA - 150# 1-1/2" Displacement per rev. .35 gal./1.33 liter
PUMPHOSE INNER DIAMETER 1.576 Inch (40mm)



NOTES:
* Minimum running drive torque requirement below this hp is 1,400 in. lbs. Depending on operating environment, starting torque can be two to three times running torque.

For temperatures higher than 175°F, consult factory.

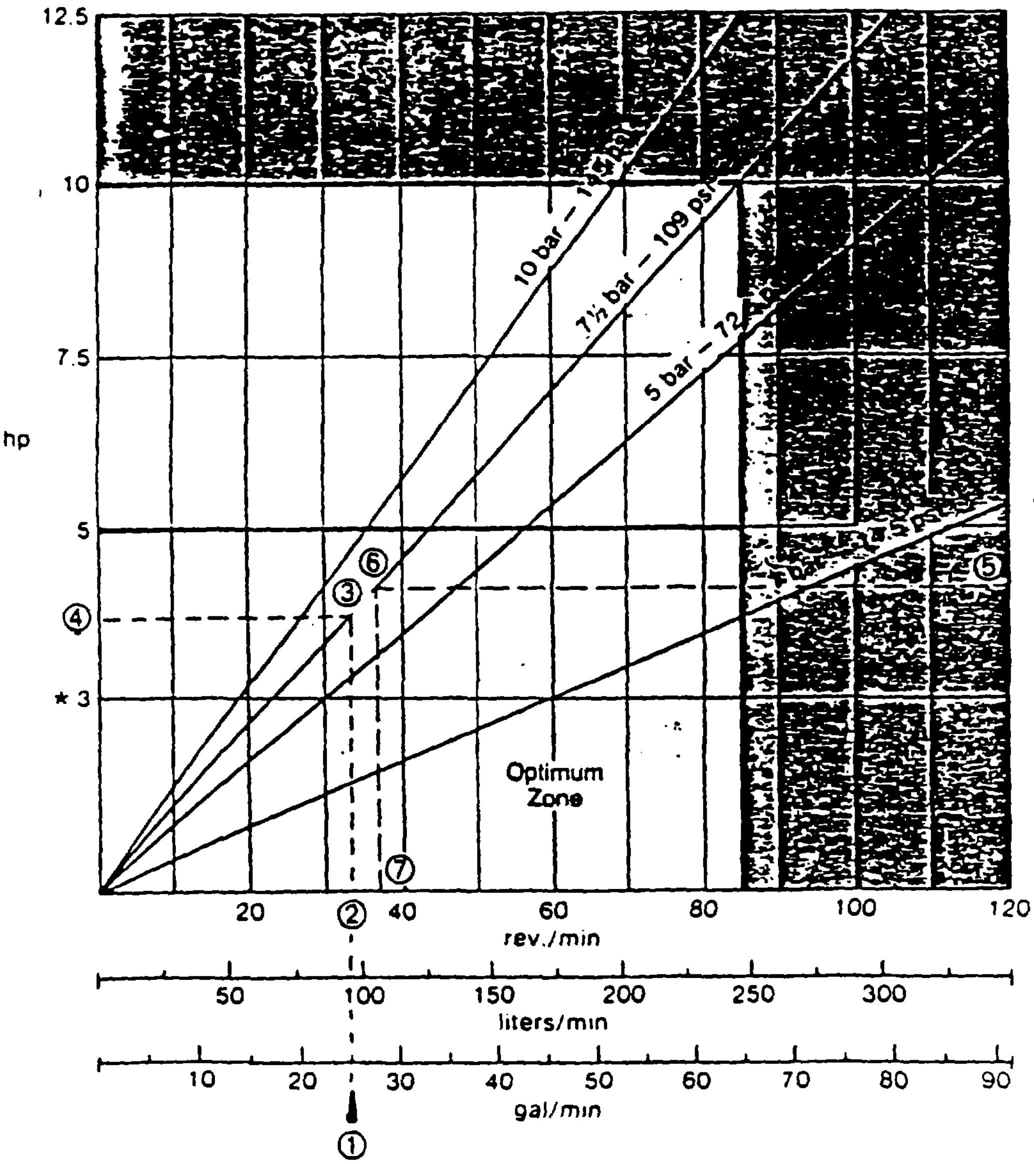
**For maximum hose life, speed point (2) should be lower than temp. adjusted speed point (7) See example points (1) thru (7)

PERFORMANCE CHART

How To Calculate Speed/Horsepower
① Flow Required
② Required Speed
③ Calculated Pressure
④ Horsepower Required
⑤ Fluid Temperature
⑥ Calculated Pressure
⑦ Max. Recommended R.P.M.**

TYPE SP/50

PORTS ASA - 150# 1-1/2" Displacement per rev. .76 gal./2.88 liter
PUMPHOSE INNER DIAMETER 1.97 Inch (50mm)

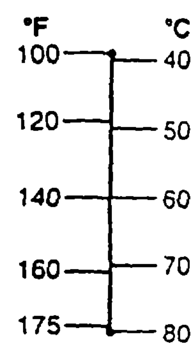


NOTES:

* Minimum running drive torque requirement below this hp is 2,400 in. lbs. Depending on operating environment, starting torque can be two to three times running torque.

For temperatures higher than 175°F, consult factory.

**For maximum hose life, speed point (2) should be lower than temp. adjusted speed point (7). See example points (1) thru (7).



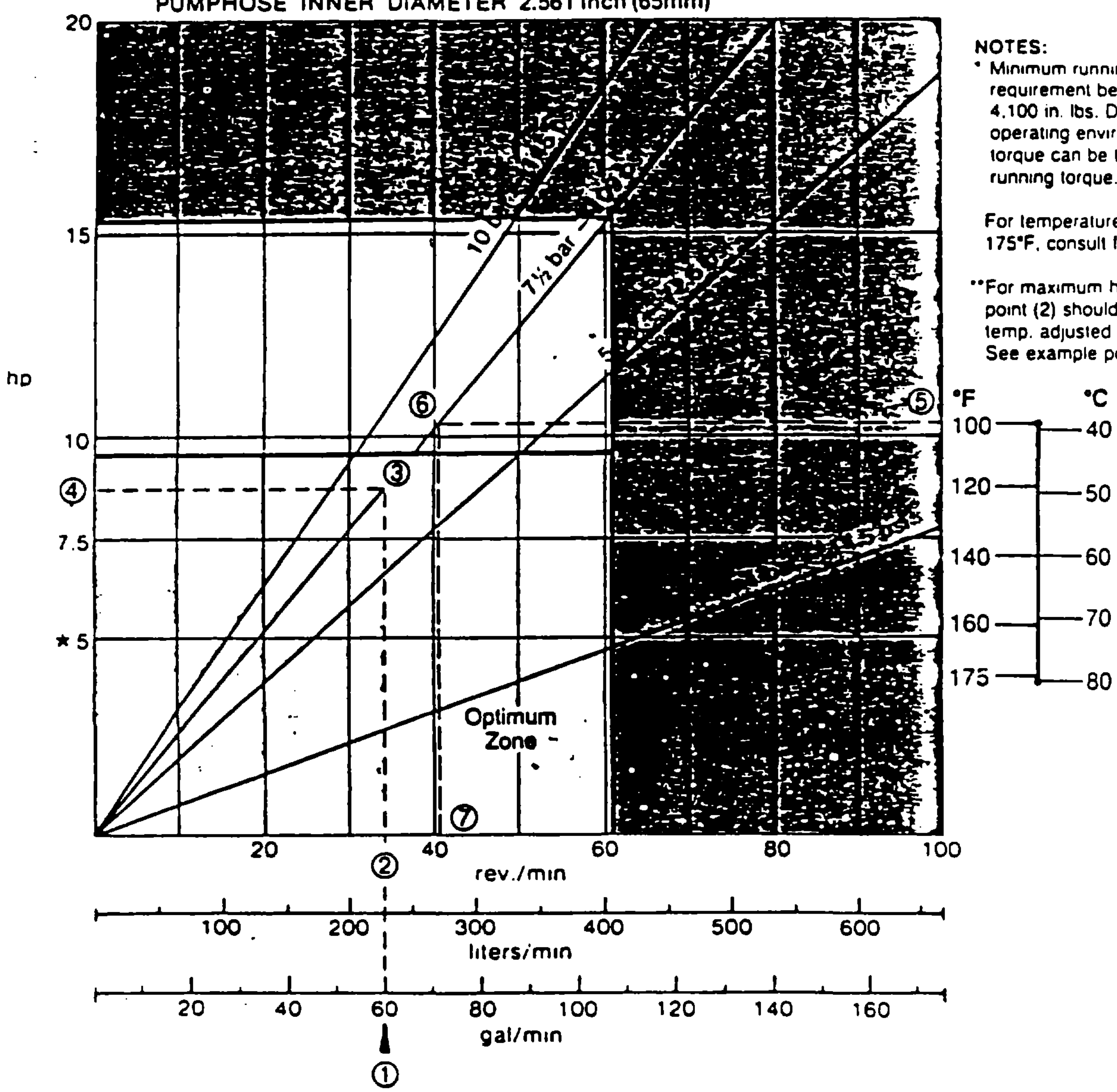
PERFORMANCE CHART

How To Calculate Speed Horsepower

① Flow Required
② Required Speed
③ Calculated Pressure
④ Horsepower Required
⑤ Fluid Temperature
⑥ Calculated Pressure
⑦ Max. Recommended R P M.**

TYPE SP/65

PORTS ASA - 150# 2-1/2" Displacement per rev. 1.75 gal./6.62 liter
PUMPHOSE INNER DIAMETER 2.561 Inch (65mm)



NOTES:
* Minimum running drive torque requirement below this hp is 4,100 in. lbs. Depending on operating environment, starting torque can be two to three times running torque.

For temperatures higher than 175°F, consult factory.

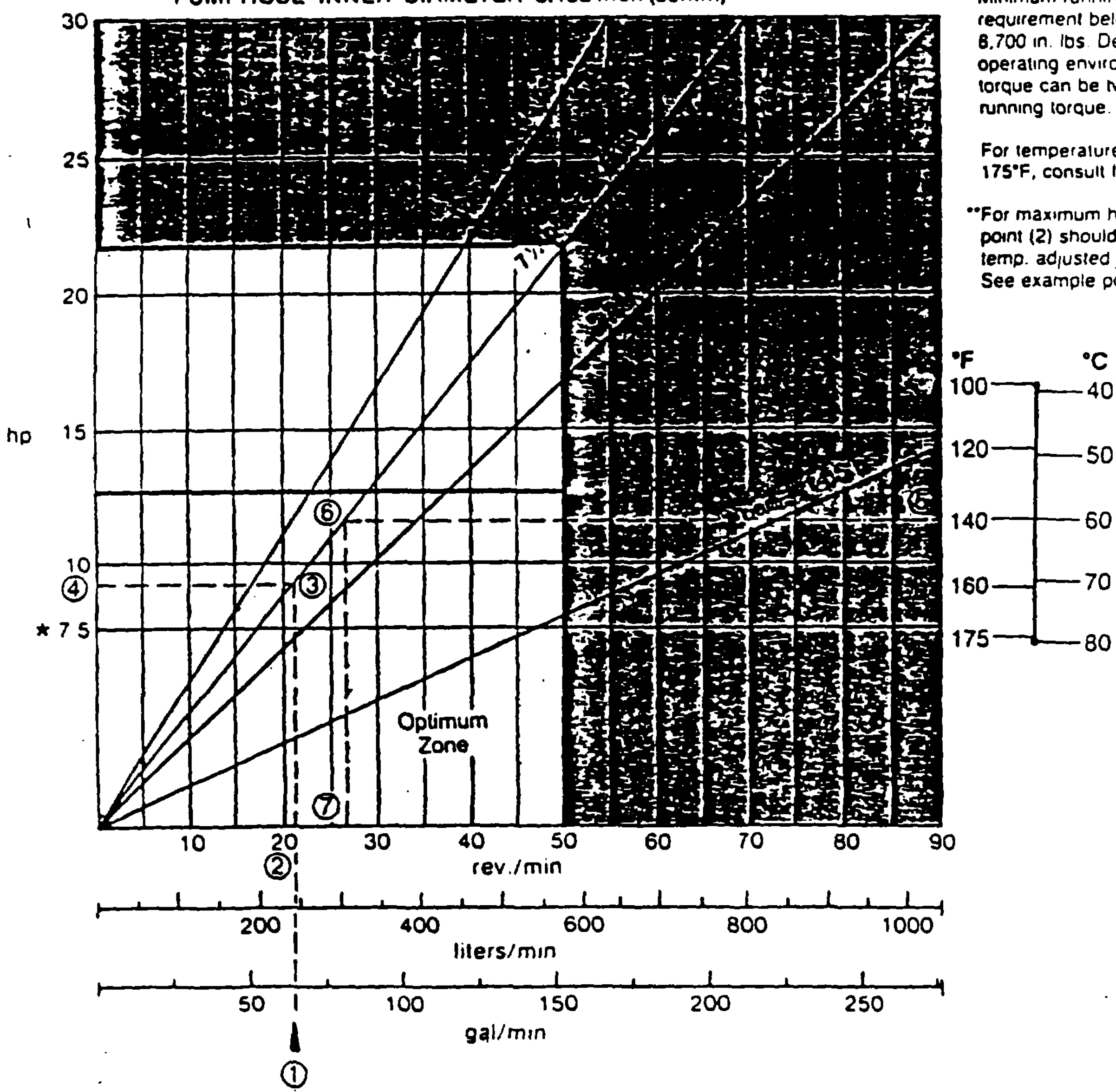
**For maximum hose life, speed point (2) should be lower than temp. adjusted speed point (7). See example points (1) thru (7).

PERFORMANCE CHART

How To Calculate Speed/Horsepower
① Flow Required
② Required Speed
③ Calculated Pressure
④ Horsepower Required
⑤ Fluid Temperature
⑥ Calculated Pressure
⑦ Max. Recommended R.P.M **

TYPE SP/80

PORTS ASA - 150# 3" Displacement per rev. 3.08 gal./11.7 liter
PUMPHOSE INNER DIAMETER 3.152 Inch (80mm)



NOTES:
* Minimum running drive torque requirement below this hp is 8,700 in. lbs. Depending on operating environment, starting torque can be two to three times running torque.

For temperatures higher than 175°F, consult factory.

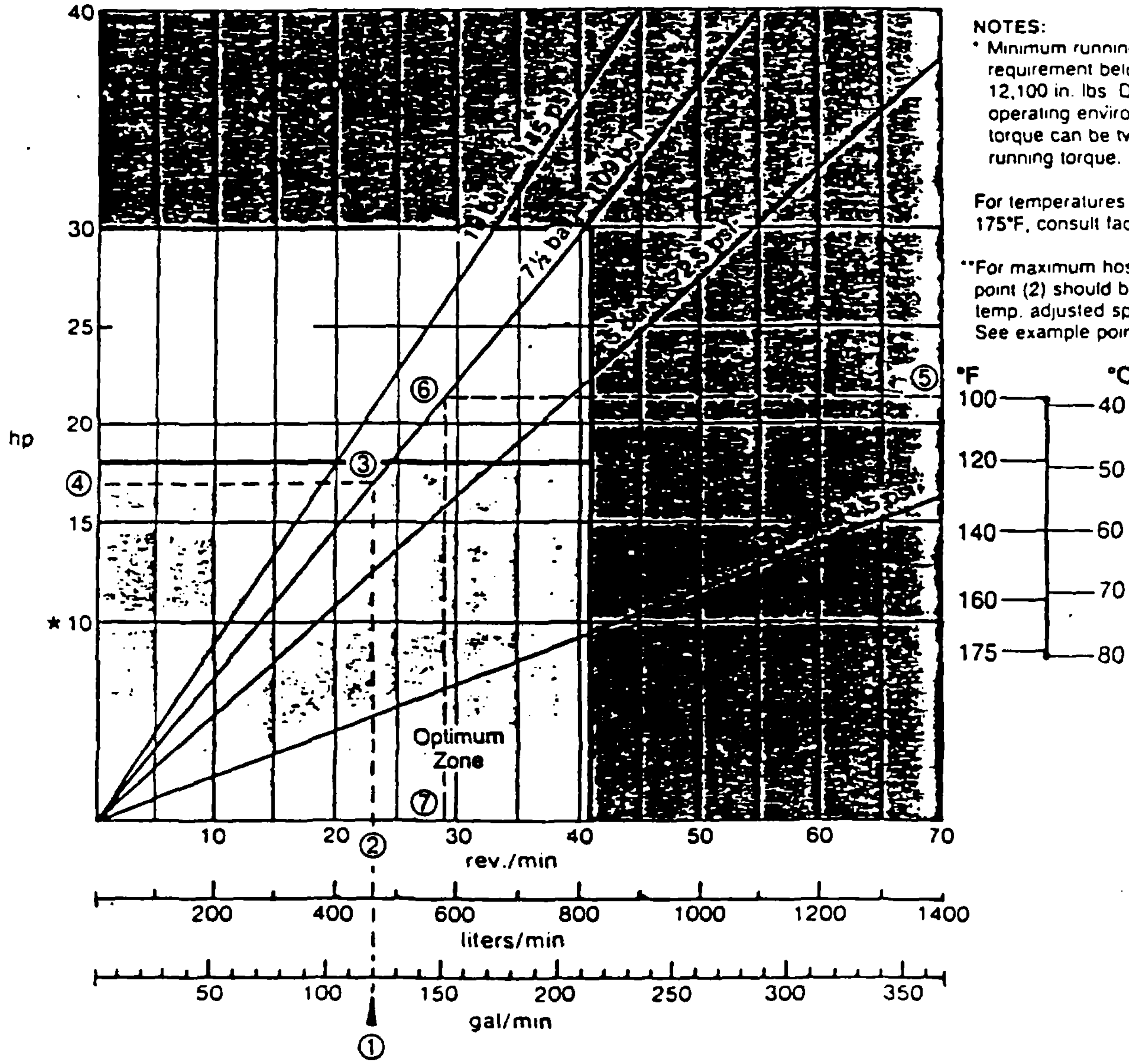
**For maximum hose life, speed point (2) should be lower than temp. adjusted speed point (7). See example points (1) thru (7).

PERFORMANCE CHART

How To Calculate Speed Horsepower
① Flow Required
② Required Speed
③ Calculated Pressure
④ Horsepower Required
⑤ Fluid Temperature
⑥ Calculated Pressure
⑦ Max. Recommended R.P.M **

TYPE SP/100

PORTS ASA - 150# 4" Displacement per rev. 5.25 gal./19.9 liter
PUMPHOSE INNER DIAMETER 3.94 inch (100mm)



NOTES:
* Minimum running drive torque requirement below this hp is 12,100 in. lbs. Depending on operating environment, starting torque can be two to three time running torque.

For temperatures higher than 175°F, consult factory.

**For maximum hose life, speed point (2) should be lower than temp. adjusted speed point (7). See example points (1) thru (7).

Chemical Compatibility of Buna and Natural Rubber Hose Material

The following, is a partial list of common fluids which can be handled by WAUKESHA/Bredel HOSEPUMPS incorporating buna or natural rubber hoses. Many other liquids can be handled at a variety of conditions. This list is intended as a guide only and Waukesha reserves the right of approval of all applications.

- Acetone*
- Alcohol
- Aluminum Chloride
- Aluminum Fluoride
- Aluminum Hydroxide
- Aluminum Sulfate
- Ammonium Chloride
- Ammonium Hydroxide*
- Ammonium Nitrate
- Ammonium Sulfate
- Amyl Alcohol
- Amylether
- Barium Chloride
- Barium Sulfate
- Barium Sulfide
- Bismuth Carbonate
- Black Sulfate Liquor
- Borax
- Butyl Ether
- Butyl Glycol
- Butyl Stearate
- Calcium Acetate
- Calcium Carbonate
- Calcium Ehlorate
- Calcium Chloride
- Calcium Hydroxide
- Calcium Sulfate
- Calcium Sulfide
- Castor Oil
- Caustic Soda
- Cellulose Acetate
- Copper Chloride
- Copper Cyanide
- Copper Sulfate
- D.d.t. 2 - Kerosene
- Di-ethyl Amine*
- Di-ethyl-ether
- Di-ethyl-glycol
- Di-iso-propyl-ether
- Di-methyl-formamide
- Ethanolamine
- Ethylcellulose*
- Ethylene Glycol
- Ethyl Alcohol
- Ethyl-propyl-ether
- Ethyl Silicate
- Formaldehyde
- Fuel Oil
- Gasoline 100 Octane
- Glycerine
- Glycol
- Green Sulfate Liquor
- Hexane
- Hexyl-Alcohol
- Isopropyl Acetate*
- Isopropylether
- Magnesium Chloride
- Magnesium Hydroxide*
- Magnesium Nitrate
- Magnesium Sulfate
- Mercuric Chloride
- Mercury
- Methanol
- Methyl Aniline*
- Methyl Iodide*
- Mineral Oil
- Nickel Chloride
- Nickel Sulfate
- Sodium Acetate
- Sodium Bicarbonate
- Sodium Chloride
- Sodium Cyanide
- Sodium Silicate
- Sodium Sulfide
- Sulfate
- Talc Slurry
- Tallow
- Turpentine
- Vinyl Chloride*
- Water 180 deg. F.
- Zinc Acetate
- Zinc Ammonium Chloride

*These fluids require the use of natural rubber hoses

PERISTALTIC TYPE
HOSEPUMP

LAKE POLY-

AND

ACID PITS

LAKE POLY

This solid waste management unit (SWMU) was used (and closed) during the period in which Stepan Chemical Company, Inc. and/or its predecessor National Polychemicals Inc. owned and operated this facility (1953-1980). The attached report contains information pertaining to this unit. It was prepared prior to Olin's acquisition of the property and extracted from those files/records retained at the facility. Accordingly, Olin cannot attest to the accuracy or the completeness of the information pertaining to the operation or design of this unit. Olin, however, has been advised by former Stepan employees that most of the plant's process wastewaters were discharged through this SWMU.

Stepan Chemical Company, Inc., Edens & Winnetka Roads, Winnetka, Illinois 60093-0000, (312-446-7500) should be contacted for more detailed information regarding this SWMU.

ACID PITS

These three solid waste management units (SWMU) were used (and closed) during the period in which Stepan Chemical Company, Inc. and/or its predecessor National Polychemicals Inc. owned and operated this facility (1953-1980). The attached report contains information pertaining to these units. It was prepared prior to Olin's acquisition of the property and extracted from those files/ records retained at the facility. Accordingly, Olin cannot attest to the accuracy or the completeness of the information pertaining to the operation or design of this unit. Olin, however, has been advised by former Stepan employees that most of the plant's process wastewaters were discharged to these units.

Stepan Chemical Company, Inc., Edens & Winnetka Roads, Winnetka, Illinois 60093-0000, (312-446-7500) should be contacted for more detailed information regarding this SWMU.

POLLUTION CONTROL STUDY

FOR

NATIONAL POLYCHEMICALS INC.

AT

Wilmington, Massachusetts

Job No. E-3341
August 21, 1969

The Badger Company, Inc.
Cambridge, Massachusetts

INTRODUCTION

This report presents a summary of aqueous waste disposal practices and pollution control recommendations for National Polychemicals Incorporated, Wilmington, Massachusetts. Contained herein is a description of the sewer systems as well as all processes from which aqueous wastes emanate. Recommendations are offered which will expedite the design of waste pre-treatment facilities as required by the Sewerage Division of the Metropolitan District Commission.

TABLE OF CONTENTS

SECTION I

SUMMARY AND RECOMMENDATIONS

1.1 SUMMARY

As of August 15, 1969, National Polychemicals Inc. completed a major waste abatement and segregation program. As a result of the installation of closed cooling water systems, the volume of aqueious wastes have been reduced by approximately 90%. All process wastes which previously flowed into the Aberjona River have been segregated into two separate sewer systems which discharge into an enclosed acid pit southeast of the plant. The contents of the acid pit seep into the ground water table. Yard drains and floor drains from the plant flow ultimately into the Aberjona River. Sanitary wastes are treated in septic tank-field tile systems.

National Polychemicals Inc.'s waste segregation project was designed to abate pollution of the Aberjona River and to prepare for pretreatment of all process wastes prior to discharge into a new Metropolitan District Commission sewer. Construction of the proposed Metropolitan District Commission sewer which will be located adjacent National Polychemicals Inc.'s property is scheduled for completion during mid-1970.

1.2 RECOMMENDATIONS

1.21 Segregation

Floor drains in processing areas should be rerouted into the process sewer system to eliminate the possibility of a spill reaching the Aberjona River.

All storage tanks which receive bulk truck shipment of liquid chemicals should be curbed to prevent contamination of yard drainage from spills which occur during unloading. Curbed areas should be drained to the process sewer system. (Ref. Fig. I)

1.22 Preparation for Pretreatment

At the present time it appears that at least flow equilization and neutralization of process wastes will be required as a prerequisite for discharge into the Metropolitan District Commission sewer system. Additionally, it appears that a rationally designed oil interceptor should be installed in the yard drainage sewer system to prevent floating material from reaching the Aberjona River.

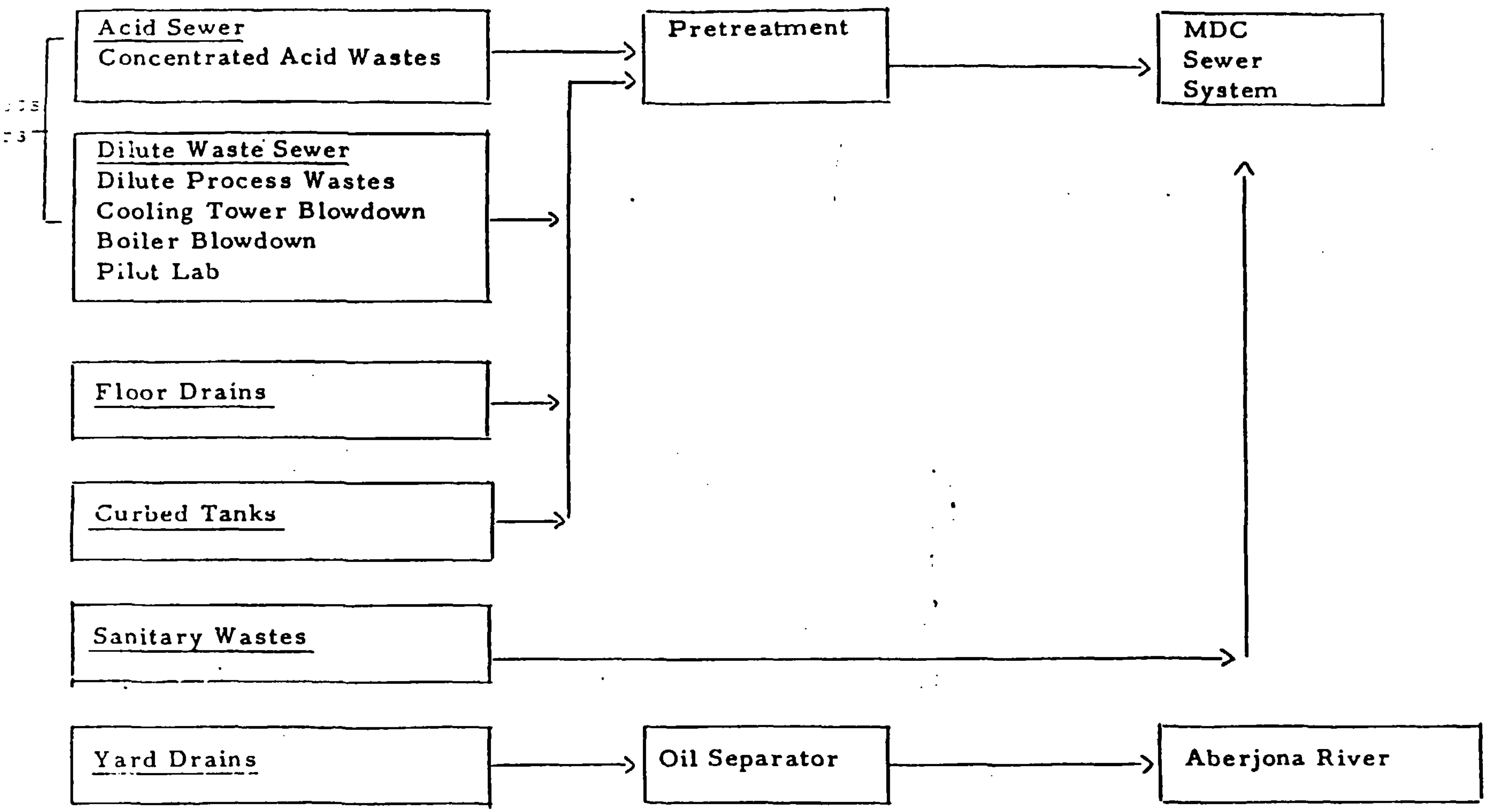


FIGURE I

NATIONAL POLYCHEMICALS INC.

Recommended Sewer Systems

1.22 Preparation for Pretreatment (cont'd)

To expedite the design of adequate pretreatment facilities a waste survey should be initiated as soon as possible. The following tests should be completed on the effluent from the process sewers and the yard drain sewer.

Flow rate
pH
Alkalinity
Acidity
Suspended Solids (before and after neutralization with sodium hydroxide and calcium hydroxide)
Oil and Grease
COD
BOD

Since the wastes emanate from batch or semi-batch operations the analyses should be performed on composite, flow proportioned samples. Laboratory analyses should conform to methodology presented in Standard Methods for the Examination of Water and Waste Water, 12th Ed. A. P. H. A., Inc. (Ref. Appendix)

SECTION II

DISCUSSION

2.1 SEWER SYSTEM

National Polychemicals Inc. has undertaken a project to segregate plant sewer systems. The new sewer systems were completed August 15, 1969. There are now three distinct sewer systems consisting of a sanitary sewer system, process sewer system and a yard and floor drainage sewer system. (Ref. Fig. II)

Sanitary sewage from various locations flows via the sanitary sewer to septic tanks for gross solids removal. The effluent from the septic tanks is allowed to leach into the ground by means of conventional tile field systems.

A new 4" - 6" acid sewer system of Bondstrand series 5000 epoxy has been installed to handle concentrated acid wastes from plants C-1, C-3 and Bldg. 17. The strong acid wastes from the new acid sewer are discharged into the acid pit southeast of the plant. Construction of the new acid system was completed August 15, 1969. (Ref. Dwg. E-3191-240A)

A dilute waste system of cast iron and vitrified clay has been installed and is used to collect all process wastes other than strong acids. This dilute waste system also empties into the acid pit southeast of the plant.

All yard drainage and process area floor drainage is collected in trench drains and is discharged to a sewer which has been installed in the area where Lake Poly used to be. The yard and floor drainage system was completed August 15, 1969. The yard drainage system discharges into the creek which subsequently flows into the Aberjona River. (Ref. Dwg. E-3191-240A)

Three acid pits with a total surface area of about one half an acre are situated on an east-west line 400 ft. south of the National Polychemicals Inc. railroad spur. The center, and largest, pit has been used to contain acid wastes from the Kempore process. The liquid level in the pits appears to be about 10 ft. below grade. The east and west pits exhibit emergent vegatation and algal growths. Due to the acid environment there is apparently no life in the center pit. Since the average rainfall in New England exceeds evapo-tranpiration by approximately 20 inches per year and there are no outlets, the contents of the acid pits probably leach into the ground water table. (Ref. Dwg. E-3191-240A)

2.2 SOURCES OF WASTES

2.21 Sanitary Wastes

The sanitary sewer system services 5 urinals, 7 water clo

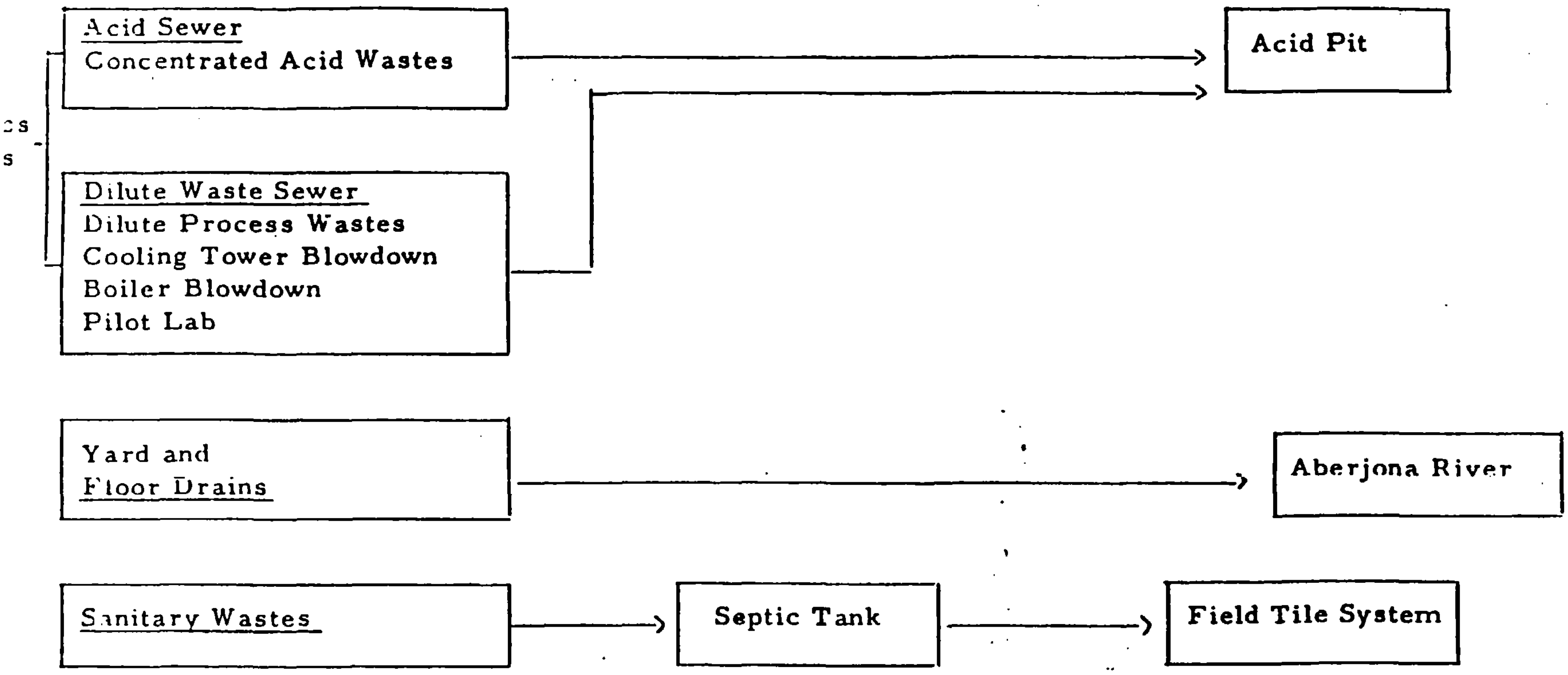


FIGURE II

NATIONAL POLYCHEMICALS INC.

SEWER SYSTEMS

as of August 15, 1969

2.21 Sanitary Wastes (cont'd)

office personnel and 53 production personnel use these fixtures on a daily basis. The sanitary systems flow into two septic tanks and subsequently into leaching fields.

2.22 Process Wastes

At present National Polychemicals Inc. is operating four processes and a coating manufacturing facility. By December 1, 1969 a fifth process facility will be in operation. The following is a synopsis of the processes with particular attention given to the wastes emanating from each process.

2.23 Process Descriptions

Opex Process (Ref. Dwg. E-3341-101A) /Dinitropentamethylenetetramine (DNPT)/ is a light yellow, slightly water soluble solid used as a blowing agent in the production of expanded rubber compounds. National Polychemicals Inc. produces 1.2×10^6 lb/yr of DNPT in 4-5 batches per 24 hours, six days per week.

Anhydrous ammonia and formaldehyde are reacted in an agitated batch type reactor fitted with an external pump through cooler to form 30% solution hexamethylenetetramine (HEXA). Upon completion of the reaction in plant B the HEXA solution is pumped to a storage tank located in plant A. HEXA and sodium nitrite are mixed in a cooled, covered compound tank. The contents of the compound tank are pumped to one of two agitated DNPT reactors which is charged with dilute hydrochloric acid and ice. As the temperature of the reactor drops DNPT percipitates out of solution. Upon completion of the reaction the contents are pumped to one of two pan filters. The product DNPT which is retained on the filter is washed with water and manually transferred into drying pans, dried and packaged.

The filtrate from the pan filter which has a pH of approximately 4 and contains sodium chloride, sodium nitrite, formaldehyde, and traces of hydrochloric acid, hexamethylenetetramine, DNPT and process oil is discharged into a retention tank where the remaining DNPT is floated off. The aqueous underflow from the retention tank is discharged to the dilute process sewer and subsequently flows into the southeast acid pit.

From material balance calculations approximately 103,000 lb/mo sodium chloride, 18,500 lb/mo formaldehyde and 10,000 lb/mo sodium nitrite are sewered from the Opex Process.

2.23 Process Descriptions (cont'd)

Kempore Process (Ref. Dwg. E-3341-101B) National Polychemicals Inc. produces 1.6 - 1.8 x 10^6 lb/yr of Kempore (Azodicarbonamide) which is a slightly water soluble, orange-yellow solid used as a rubber blowing agent. Production of Kempore is a semi-batch operation executed on a 24 hour basis 5-6 days per week.

Liquid chlorine and urea are reacted in a batch reactor located in plant C-3 to produce monochlorourea (MCU). MCU is stored in a day tank prior to a reaction with 30% sodium hydroxide in a titanium pipe reactor. The effluent from the titanium reactor is discharged into an agitated, cooled reactor where 66° Be' sulfuric acid is added producing large quantities of CO_2 which are vented to the atmosphere. The contents of the reactor are pumped to an open pan filter where a 3.0% hydrazine solution is recovered in the filtrate stream. After manual washing of the filter cake consisting of sodium sulfate and sodium chloride, the cake is dumped into an agitated salt solution tank. The salts are dissolved into hot water in the salt solution tank and discharged to the dilute process sewer which flows to the southeast acid pit.

From material balance calculations approximately 300,000 lb/mo sodium sulfate and 305,000 lb/mo sodium chloride are sewered from the hydrazine production section of the Kempore Process.

The 3.0% hydrazine filtrate solution is stored in day tanks outside plant C-3 and C-1. Hydrazine solution is pumped to plant C-1 into one of three reactors where sulfuric acid is added to form hydrazodicarbonamide (HDCA) in slurry form. HDCA is filtered on a rotary drum vacuum filter to increase the HDCA concentration. The filtrate containing sodium chloride, sodium sulfate, urea and ammonium sulfate is filtered and discharged to the dilute process sewer.

The 20% slurry of HDCA is pumped into a water cooled, agitated reactor, where sulfuric acid and sodium chlorate are added forming a heavy slurry of azodicarbonamide. The azodicarbonamide slurry is vacuum filtered, dried and packaged. Filtrate from vacuum filter containing sodium sulfate, urea, azodicarbonamide and 4-8% sulfuric acid is filtered and discharged to the process acid sewer.

From material balance calculations approximately 40,000 lb/mo sodium sulfate, 164,000 lb/mo ammonium sulfate, 101,000 lb/mo urea, and 24,000 lb/mo sulfuric acid are contained in the combined filtrate streams.

2.23 Process Descriptions (cont'd)

Wytox Process (Ref. Dwg. E-3341-101C) Wytox, a liquid phosphite rubber stabilizer is produced 2-4 days per week on a batch basis amounting to one million lb/yr.

Phsophorous trichloride, paraformaldehyde and nonylphenol are reacted in an agitated vessel located in plant C-1. During the reaction 16,000 lb/mo hydrogen chloride gas evolves which is scrubbed and sewered to the acid sewer. Upon completion of the reaction the entire contents of the reactor are pumped into drums for shipping. With the exception of the scrubber liquor, there are no waste process streams which are sewered.

Wytox ADP-X Process (Ref. Dwg. E-3341-101D) Wytox ADP-X /Dioctyldiphenylamine (DODPA)/ a dark colored resinous solid is produced 3 to 5 days per week on a batch basis in plant B. National Polychemicals Inc.'s total production of DODPA is approximately 600,000 lb/yr.

Diphenylamine (DPA) and diisobutylene (DIB) undergo a Friedel-Crafts reaction through the use of an aluminum chloride catalyst. DPA and DIB are reacted with the catalyst in an agitated reactor. The reactor is fitted with a condenser and condensate drum to reflux the DIB. When the reaction has been completed, the aqueous and organic layers are allowed to separate. The aqueous layer containing sodium chloride, aluminum hydroxide, DODPA and DIB is sewered to the dilute process sewer. The organic layer is washed twice with water. Both washes are also discharged to the dilute process sewer. Following the two washings the reactor is placed under a vacuum by means of a steam jet. While under vacuum the DIB is distilled into the condensate drum leaving DODPA in the reactor. The tar-like DODPA product is discharged from the reactor and is allowed to solidify prior to grinding and packaging.

From material balance calculations approximately 19,000 lb/mo diisobutylene 1,250 lb/mo aluminum hydroxide and 2,400 lb/mo sodium chloride are discharged to the process sewer from the Wytox ADP-X Process.

O.B.S.H. Process (Ref. Dwg. E-3341-101-E) As of December 1, 1969, National Polychemicals Inc. expects to be producing 300,000 lb/yr of oxybissulfonylhydiazine (OBSH) in plant 17. OBSH, a rubber blowing agent, will be produced 5 days per week on a 24 hour basis.

Diphenyloxide and chlorosulfonic acid will undergo a quench reaction producing hydrogen chloride gas, oxybissulfonyl~~oxide~~ (OBSC), a white water insoluble solid, and a 15-20% sulfuric acid solution. The hydrogen chloride gas is to be scrubbed and recovered for reuse. The 15-20% sulfuric acid solution will be discharged into the new acid sewer which flows to the acid pit southeast of the plant. Process wasre data is being developed in a pilot plant facility.

2.23 Process Descriptions (cont'd)

O. B. S. H. Process (cont'd) - The OBSC is to be reacted with a hydrazine solution to form OBSH. The solid OBSH is to be filtered, dried and packaged. Filtrate from the product will be pumped to the Kempore Process for reuse.

Coatings National Polychemicals Inc. produces numerous coatings for rubber products. These coatings are compounded on a batch basis from the following chemicals:

Bentone
Santocel
Ufamite MM 67
Toluene
Butylacetate
Acrylic Resins
Maleic Anhydride
Glycerine
Fatty Amines
Silicone
Monoethanolamine
Mineral Oil

The production of the coatings is a non-aqueous operation without waste.

2.24 Cooling Water System

Field data has revealed that normal cooling water demands are 375 gpm with a peak demand of 555 gpm. Until recently, city water was used for cooling on a once through basis and sewered ultimately to the Aberjona River. Installation of a multi-tower closed cooling water system with a design capacity of 700 gpm was completed August 15, 1969.

The cooling towers associated with plants A, B and C-1 are to operate at a high number of cycles of concentration. Minimal blowdown to the process sewer will occur on a periodic basis. Cooling water from the plant C-3 cooling tower is to be used in the hydrazine scrubber (Kempore Process) which discharges to the process sewer and will therefore provide a 20 gpm purge for the plant C-3 cooling system.

Chemical treatment of the cooling water will be accomplished on a contract basis with a chemical supplier. The corrosion inhibition chemicals have not been selected; however, it appears than an inorganic-organic zinc inhibitor or an entirely organic inhibitor system will be used.

2.25 Boiler Systems

National Polychemicals Inc. is presently operating 15 psi boilers with a total capacity of 450 horsepower and 150 psi boilers with a total capacity of 135 horsepower. Softened city water is used for make up water. Proprietary chemicals containing amines are used for boiler scale control. Solids in the steam drum are controlled through periodic manual blowdown to the process sewer.

2.26 Yard and Floor Drainage

Yard drainage and floor washings from an area of undetermined size are sewered via the Lake Poly sewer. Contaminants from roadways, unloading areas and process areas are likely to appear in the effluent from the Lake Poly sewer system. Significant amounts of pollutants are likely to emanate from truck unloading stations such as the nonylphenol tank and process area floor drains as a result of spills.

The Lake Poly sewer now flows into an oil basin which is capable of removing gross amounts of light insoluble material. The underflow from the oil basin flows into a creek and subsequently the Aberjona River. (Ref. Dwgs. E-3191-240A and 232A)

2.3 METROPOLITAN DISTRICT COMMISSION SEWER SYSTEM

During the summer of 1970 a Metropolitan District Commission sewer is to be extended along National Polychemical Inc.'s property. (Ref. U.S.G.S. Map) The sewerage division of the Metropolitan District Commission will accept sanitary sewage as well as industrial wastes in the Metropolitan District Commission sewer system as long as the wastes conform to the following rules and regulations.

RULES AND REGULATIONS

COVERING

DISCHARGE OF SEWAGE, DRAINAGE, SUBSTANCES OR WASTES

Pursuant to authority and in compliance with the directive of the Massachusetts Legislature as found in Massachusetts Acts of 1945, Chapter 705, Section 12, the Metropolitan District Commission, at its regular meetings on August 5 and 19, 1948, voted to establish the following rules and regulations covering the discharge of sewage, drainage, substances or wastes into any sewer under its control, or any sewer tributary thereto, with the North Metropolitan Sewerage District or the South Metropolitan Sewerage District.

Attention is invited to the fact that the above referred to legislation provides that failure on the part of any municipality to comply with the following [illegible]

1. No municipality shall discharge or cause or allow to be discharged into any sewer under the control of the Metropolitan District Commission, or any sewer tributary thereto within the North or South Metropolitan Sewerage Districts, any sewage, drainage, substances or wastes containing caustic alkalinity, calculated as $CaCO_3$ (calcium carbonate), in excess of 75 parts per million by weight, in volumes which may be determined by the Metropolitan District Commission to be excessive.

2. No municipality shall discharge or cause or allow to be discharged into any sewer under the control of the Metropolitan District Commission, or any sewer tributary thereto within the North or South Metropolitan Sewerage Districts, any sewage, drainage, or substances or wastes containing unsaponified greasy or fatty matters in volumes which may be determined by the Metropolitan District Commission to be excessive.

3. No municipality shall discharge or cause or allow to be discharged into any sewer under the control of the Metropolitan District Commission, or any sewer tributary thereto within the North or South Metropolitan Sewerage Districts, any sewage, drainage, substances or wastes containing suspended solids in excess of five hundred parts per million by weight in volumes which may be determined by the Metropolitan District Commission to be excessive, or any matters in such volumes as, in the opinion of the Commission, may tend to obstruct or impede the flow in the sewers, or be injurious to the sewers, pumps or other portions of the sewerage systems or be likely to create a nuisance or a hazard within or without said sewers.

4. No municipality shall discharge or permit to be discharged into any sewer under the control of the Metropolitan District Commission, or any sewer tributary thereto, within the North or South Metropolitan Districts, free mineral acids in quantities which the Metropolitan District Commission determines to be excessive.

5. No municipality shall cause or allow to be discharged into any sewer under the control of the Metropolitan District Commission or any sewer tributary thereto within the North and South Metropolitan Sewerage Districts, any sewage, drainage, substances or wastes from an industrial or manufacturing plant unless measuring devices or other means of measuring the flow of the sewage, drainage, substances or wastes are provided at the request of and in accordance with the approval of the Metropolitan District Commission, and the records of flow from such measuring devices shall be furnished the Metropolitan District Commission upon request therefor.

6. All applications to discharge any sewage, drainage, substances or wastes directly into any sewer under the control of the Metropolitan District Commission shall be accompanied by an agreement signed jointly by the owner,

of the industry contributing such sewage, drainage, substances or wastes and a representative of the municipality in which the connection is located who is authorized to sign agreements on behalf of the said municipality stating that the manufacturer or industry in question agrees to abide by all rules and regulations of the municipality and the Metropolitan District Commission and that the owner of the industry will provide suitable devices or other means of measurin the flow of the sewage, drainage, substances or wastes and will provide such work for the preliminary treatment of the sewage, drainage, substances or wastes as may be required by the Metropolitan District Commission.

7. No municipality shall discharge or cause or allow to be discharged into any sewer under the control of the Metropolitan District Commission or any sewer tributary thereto within the North or South Metropolitan Sewerage Districts, any sewage, drainage, substances or wastes which are of an explosive or inflammable nature.

8. Municipalities will be held responsible for the enforcement of Section 2 of the rules and regulations of the Massachusetts Department of Public Safety necessitating that garages and other establishments where gasoline is used and which are connected with the public sewers in the North or South Metropolitan Sewerage Districts be supplied with a suitable trap or separator. Such traps and separators shall be subject to the approval of the Metropolitan District Commissio

9. No municipality shall contract for the building of additional sewerage works contemplated for connection into the Metropolitan Sewerage System until plans and specifications covering such works are submitted to and approved by the Chief Sewerage Engineer of the Metropolitan District Commission, and notice is hereby given that the Metropolitan District Commission will not approve, except under extraordinary conditions, any works designed on the so-called combined system or the discharge of processing or condensing water which the Department of Public Health determines is sufficiently free from contamination to permit its discharge into the nearest water course.

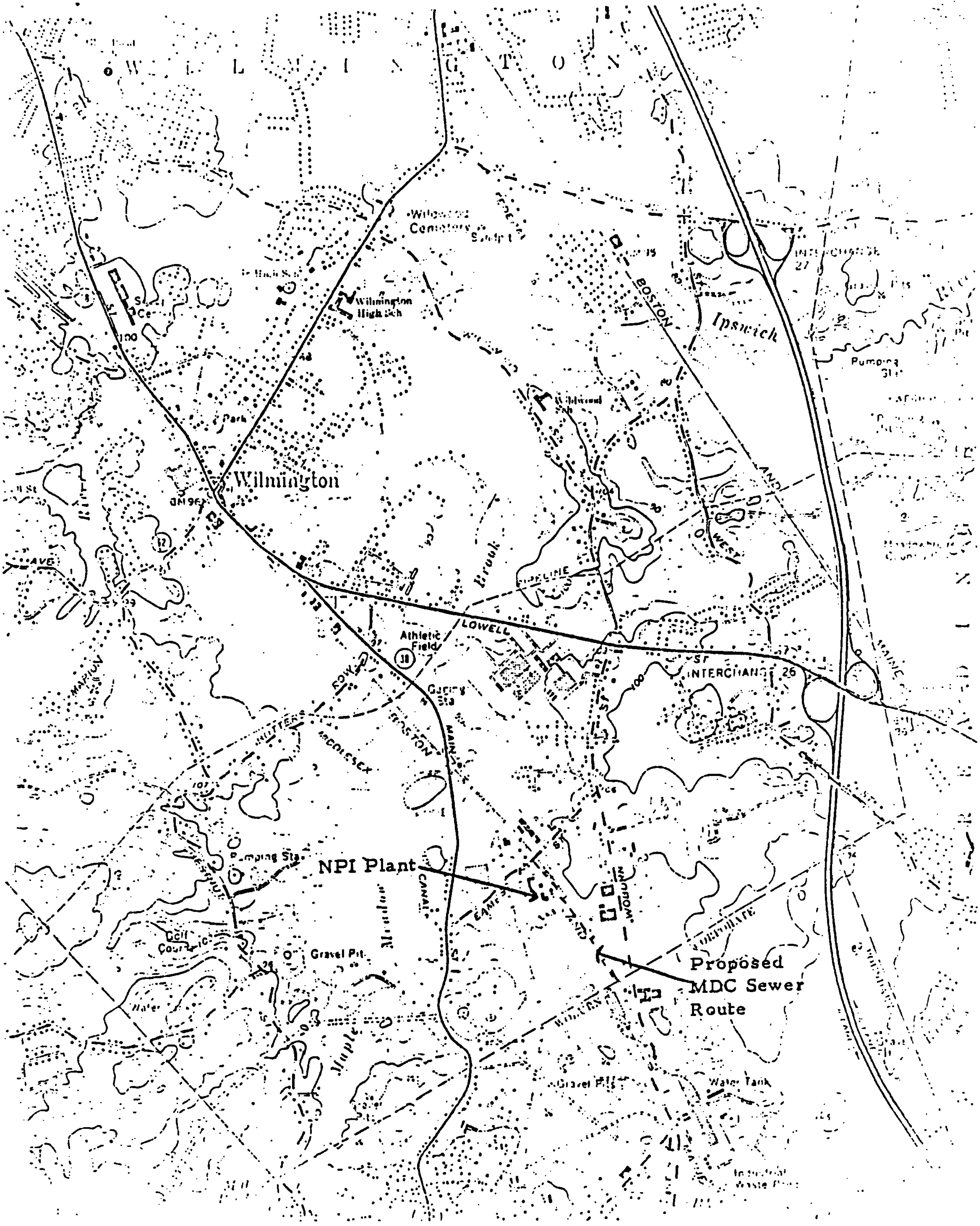
10. No municipality shall discharge or permit to be discharged into the Metropolitan Sewerage System, or tributaries thereto, sewage, drainage, substances or wastes containing amounts of ground, tide, or river water determined by the Metropolitan District Commission to be excessive.

* Now Section 28 of Form F.P.R.-14 of the Rules and Regulations of the Board of Fire Prevention of the Department of Public Safety.

SECTION III

APPENDIX

3.1 U.S.G.S. Map

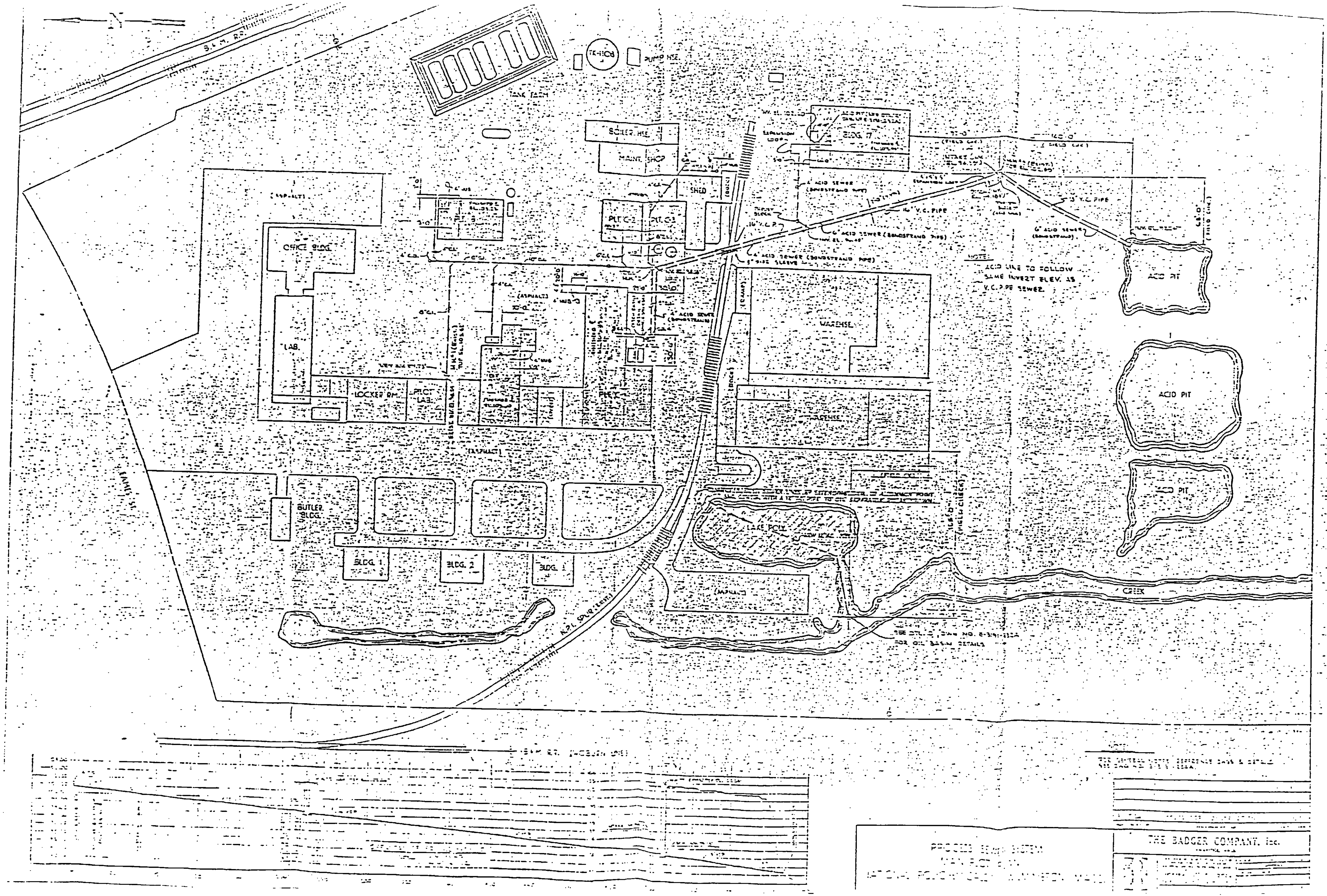

Wilmington
Wilmington High Sch
Ipswich
Brook
LOWELL
ST
INTERCHANGE 26
BOSTON
MAIN
CANAL
Athletic Field
Pumping Sta
Gravel Pit
Meadow
Maple
Gravel Pits
Water Tank
NPI Plant
Proposed
MDC Sewer
Route

3.2 DRAWINGS

E-3191-231A	Process Sewer System Plant A
E-3191-232A	Process Sewer System Plan and Details Plant B
E-3191-234A	Process Sewer System Plan and Details Plants C-2 and C-3
E-3191-235A	Process Sewer System Plant C-1
E-3191-240A	Process Sewer System Main Plot Plan

Dwg. No. 3191-231A

Dwg. No. 3191-232A



TANK FARM
PUMP HSE.
BOILER HSE.
MAINT. SHOP
SHED
BLDG. 7
PLT. C-2
PLT. C-1
(ASPHALT)
OFFICE BLDG.
LAB.
LOCKER RM.
PILOT LAB.
WAREHSE.
16" V.C. PIPE
NOTE:
ACID LINE TO FOLLOW
SAME INVERT ELEV. AS
V.C. PIPE SEWER.
ACID PIT
ACID PIT
ACID PIT
BUTLER BLDG.
BLDG. 1
BLDG. 2
LAKE POLY
CREEK
THE BADGER COMPANY, Inc.

OTHER DISPOSALS

BURIAL TRENCH IN THE VICINITY OF THE EAST AND WEST WAREHOUSES

This solid waste management unit (SWMU) was used (and closed) during the period in which Stepan Chemical Company, Inc. and/or its predecessor National Polychemicals Inc. owned and operated this facility (1953-1980). Accordingly, Olin cannot attest to the accuracy or the completeness of information pertaining to the operation or design of this unit. Olin, however, has been advised by former Stepan employees that possibly 30-100 lb. drums of aluminum chloride and 7 drums of Kempore (azodicarbonamide) may have been disposed in this unit.

Stepan Chemical Company, Inc., Edens & Winnetka Roads, Winnetka, Illinois 60093-0000, (312-446-7500) should be contacted for more detailed information regarding this SWMU.

DRUMS NORTH OF LAGOON II

This solid waste management unit (burial trench) was used (and closed) during the period in which Stepan Chemical Company, Inc. and/or its predecessor National Polychemicals Inc. owned and operated this facility (1953-1980). Accordingly, Olin cannot attest to the accuracy or the completeness of information pertaining to the operation or design of this unit. Olin, however, has been advised by former Stepan employees that possibly drums of Opex 93 (dinitrosopentamethylenetetramine) and Kempore (azodicarbonamide) may have been disposed of in this unit.

Stepan Chemical Company, Inc., Edens & Winnetka Roads, Winnetka, Illinois 60093-0000, (312-446-7500) should be contacted for more detailed information regarding this SWMU.

OPEX VICINITY OF LAGOON I

This solid waste management unit (SWMU) was used (and closed) during the period in which Stepan Chemical Company, Inc. and/or its predecessor National Polychemicals Inc. owned and operated this facility (1953-1980). Accordingly, Olin cannot attest to the accuracy or the completeness of the information pertaining to the operation or design of this unit. Olin, however, has been advised by former Stepan employees that possibly Opex (dinitrosopentamethylenetetramine) material may have been disposed of in this area.

Stepan Chemical Company, Inc., Edens & Winnetka Roads, Winnetka, Illinois 60093-0000, (312-446-7500) should be contacted for more detailed information regarding this SWMU.

OPEX DRUMS WEST OF WEST WAREHOUSE

This solid waste management unit (burial trench) was used (and closed) during the period in which Stepan Chemical Company, Inc. and/or its predecessor National Polychemicals Inc. owned and operated this facility (1953-1980). Accordingly, Olin cannot attest to the accuracy or the completeness of the information pertaining to the operation or design of this unit. Olin, however, has been advised by former Stepan employees that possibly 100 drums of Opex (dinitrosopentamethylenetetramine) may have been disposed of in this unit.

Stepan Chemical Company, Inc., Edens & Winnetka Roads, Winnetka, Illinois 60093-0000, (312-446-7500) should be contacted for more detailed information regarding this SWMU.

SEPTIC TANKS

QUESTION 1:

SWMU: Septic Tank (Three active: 1) west of pilot plant, 2) south of boiler house, 3) between east and west warehouses

b) Type of Unit: Septic Tank

Dimensions: 1) 9 ft. x 6 ft. x ? plus drain field - see attached drawing
2) Unknown
3) Unknown

Information on how unit was designed, constructed, operated and maintained: Unknown - see attached Drawing A for Unit 1.

c) Date in use: Unknown to present

d) Quantity and Type(s) of wastes managed in unit: Sanitary

e) Releases of hazardous wastes or hazardous constituents: None to the best of our knowledge

f) Information, data and documentation concerning any releases: None

g) Corrective actions: None required

For more detailed information pertaining to the design, construction, operation, maintenance or regarding any possible releases prior to Olin's acquisition on September 15, 1980, please contact Stepan Chemical Company, Inc., Edens and Winnetka Roads, Winnetka, Illinois 60093-0000, (312) 446-7500.

INACTIVE SEPTIC TANKS

TILE FIELD SOUTH OF PLANT A, TILE FIELD EAST OF PLANT B

These solid waste management units (Septic Tanks) were used (and closed) during the period in which Stepan Chemical Company, Inc. and/or its predecessor National Polychemicals Inc. owned and operated this facility (1953-1980). The attached drawings contain information pertaining to these units. They were prepared prior to Olin's acquisition of the property and extracted from those files/records retained at the facility. Accordingly, Olin cannot attest to the accuracy or the completeness of the information pertaining to the operation or design of these units. The volume and composition of material discharged to these two as well as other "septic type fields" that have been uncovered during plant construction excavations is unknown.

Stepan Chemical Company, Inc., Edens & Winnetka Roads, Winnetka, Illinois 60093-0000, (312-446-7500) should be contacted for more detailed information regarding this SWMU.

PCB CAPACITOR FIRE

QUESTION 2:

Other units that hold or have held hazardous substances and from which there have been releases of hazardous constituents: PCB capacitor

b) Type of unit: Electrical Capacitor

Dimensions: Unknown

c) Dates in use: 01/01/65-8/24/85

d) Quantity and types of hazardous substances managed in unit: 16.4 kilograms of PCB;s

e) Dates, quantity and types of any known releases: August 24, 1985 capacitor ruptured and spilled material also minor fire erupted

f) Information, data, documentation concerning any releases: Analysis of spill area after cleanup is attached

g) Corrective actions (completed or underway): Capacitor removed and sent offsite for disposal. Emergency contractor (Clean Harbors, Inc.) performed cleanup of area and material immediately after failure. DEQE and NRC notified. Fire Department and MA DEQE responded.

MDT
For your files
9/?/85

RECEIVED
OCT 3 1 1985
T. W. O'GRADY

CleanHarbors inc.

OLIN/WILMINGTON
2
PURCHASING

RECEIVED
OCT 2 1985
OLIN CORP.
MDT

October 23, 1985

Olin, Corporation
51 Eames Street
Wilmington, Mass 01887
Attn: Brenda

Dear Brenda:

Enclosed please find the results of the analysis Clean Harbors, Inc., has performed for you.

If there are any questions please feel free to contact me at our Boston office number (617)269-5830.

Sincerely,

Fran Matuszewski

Fran Matuszewski
Environmental Field Chemist

AD/lc

CleanHarbors

OF NATICK, INC.

REPORT OF ANALYSIS

Sample Identification: Olin Corp.
Wilmington, MA PCB Wipe Samples

Clean Harbors, Inc.
100 Joseph St.
P. O. Box 193
Kingston, MA 02364

Attn: Mr. Robert Remmes

Date Received: 8/30/85

CHNA Lab #: 15415-15424

P. O. #: Willett

Job # 7852K

Sample Identification	MDL (ug/100 cm^2)	Total PCB's* Conc. (ug/100 cm^2)	Size of Sample Area (cm^2)	Extraction Date	Analysis Date
A	0.036	8.9	1394	9/5/85	9/26/85
B	0.036	40	1394	9/5/85	9/26/85
C	0.027	78	1858	9/5/85	9/26/85
D	0.036	17	1394	9/5/85	9/26/85
E	0.036	340	1394	9/5/85	9/26/85
F	0.036	190	1394	9/5/85	9/26/85
G	0.027	2,400	1858	9/5/85	9/26/85
H	0.036	6.1	1394	9/5/85	9/26/85
K	0.054	27	929	9/5/85	9/26/85
L	0.015	3.8	3226	9/5/85	9/26/85

This laboratory follows quality assurance/quality control procedures outlined in EPA Publication EPA-600/4-79-019 "Handbook for Analytical Quality Control in Water and Wastewater Laboratories" March 1979 and specific QA/QC requirements of the procedures listed.

The information contained in this report is to the best of my knowledge, accurate and complete.

Notes *Aroclor 1016

Per/Date: David E. Newton 10/4/85
David E. Newton
Laboratory Manager

PLANT B TANK FARM AND VICINITY

QUESTION 2:

Other units that hold or have held hazardous substances and from which there have been releases of hazardous constituents: Plant B Production Area and Tank Farm

b) Type of unit: Six carbon steel, 15,000-gallon. Concrete dike installed in 1981. Other smaller tank(s) may have been utilized for processing/storage in this area

   Dimensions: Dike for 6 15,000-gallon tanks approximately 26 ft. x 35 ft. x 1.5 ft.

c) Dates in use: Unknown-Current

d) Quantity and types of hazardous substances managed in unit: Unknown

e) Dates, quantity and types of any known releases: Undocumented reports of releases in 50's and 60's of diisobutylene, diphenylamine, dioctylphthalate, dioctyldiphenylamine. Believed to be source of seep along east side of plant.

f) Information, data, documentation concerning any releases: None

g) Corrective actions (completed or underway): Interceptor well system was installed in 1982 and located to east of tank farm by small drainage ditch. Consists of 4 pumping wells of 1-2 gpm each, separation tank, skimmer for nonaqueous phase liquids and carbon treatment of water phase prior to in-plant usage. Interceptor well system described under Question 1, SWMU.

APPENDIX C

REMEDIAL ACTIONS
GROUNDWATER STUDIES
FIELD INVESTIGATION

APPENDIX C
ADDITIONAL PERTINENT FILE INFORMATION

The Commonwealth of Massachusetts

Peter

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
Division of Solid and Hazardous Waste

MEMORANDUM

TO: Madeline Snow

DATE: June 4, 1986

FROM: Helen Waldorf HW

SUBJECT: Olin Chemcial, Wilmington

---

1) Status under DWPC

A. Peter Dorre of DWPC was notified by Olin of a proposed plant shut-down scheduled for September. David Vaughan of Olin Chemcial in Tennessee [(615) 336-4000] is arranging a meeting to discuss future permitting requirements.

B. At the moment Olin has an NPDES permit for cooling water. They also have a remedial action plan, apparently under DWPC regulations, to treat the groundwater, which is contaminated primarily with phthalates and a variety of salts and sulfates. Treated groundwater is cycled into the plant process to cool pump seals. Since the water becomes "part of the process" and is now defined as an industrial waste, Olin is permitted to discharge the effluent to the WRA (MDC) sewer.

C. When the plant shuts down, Olin will discontinue their cooling water NPDES permit. Peter Dorre indicates that groundwater pumping and treatment will have to continue to prevent contaminated groundwater from leaching into the "East Drainage ditch". However, treated groundwater will no longer have an "industrial process" to go through. As a matter of policy, WRA (MDC) will probably not let "clean" water, e.g. treated groundwater be discharged to its sewer system. Therefore Olin will probably have to apply for a groundwater discharge permit or a surface water NPDES permit. In view of the public awareness of hazardous waste issues in the Aberjona River watershed, this may be a very sensitive undertaking. The remedial action plan does not deal with on-site residuals issues. There is also a known "hot-spot" of chromium on the site.

2) Status under 21C

A. Olin filed a part A application for interim status and on August 7, 1985 we called their part B license application.

B. On April 4, 1986 Olin requested a change of status to generator, asked that the part A be withdrawn, and submitted "closure plans" for drum and tank storage. The two lagoons (which are now lined), and sludge landfill, so far as I know, have never been regulated as hazardous waste "units".

C. Ida Barbroudi says Olin is to be inspected next week by Joe Crossen to check the drum storage and tank storage closures. Technically, under 21C, the lagoons and sludge landfill were not "regulated units" and therefore not regulable under 21C, unless we show the lagoons and landfill should have been regulated as interim status units. Under HSWA, however, (1984 RCRA amendments) EPA (not us) could decide to regulate lagoons in the future.

3) Status under 21E

A. To date this site has not been regulated under 21E. As you know we recently activated our FIT to do an updated Site Inspection Report under our MSCA program. Harish Panchal will be coordinating that task.

It appears that there are several ways to handle the Olin site:

1) DWPC would retain the lead in monitoring on-site groundwater treatment based on existing permits and anticipated new permits for treated groundwater. This alternative would not deal with issues such as on-site residuals, the lagoons and the sludge disposal landfill.

2) We could attempt to show that the lagoons and/or the landfill should have been interim-status units. If successful, closure under 21C could be required. If unsuccessful, however, the site would still be in limbo under EPA's new HSWA policies.

3) Notify the company under 21E and require the company to do a comprehensive site assessment, before the property changes hands. The disadvantage in this alternative appears to be one of staff resources. This project could easily gobble up 50% of one staff person in either the regional or Boston office.

4) Under a combination of #1 and #3 "share the work": DWPC would retain the lead to deal with the groundwater contamination treatment program. The 21E part would deal only with those issues not addressed by the company in the past under other programs - e.g. the on-site residuals, the lagoons and the landfill. This alternative would have a possible disadvantage in permitting the discharge of effluent from groundwater treatment at a site being assessed for hazardous waste issues.

cc: Peter Dorre, DWPC
Ida Barbroudi, NERO
Steve Dreeszen, Boston
Jude Hutchinson, Boston
Bob Cleary, Boston
Harish Panchal, Boston
Rodene DeRice, NERO

TELEPHONE CONVERSATION MEMORANDUM

CLIENT MDEQE

PROJ. No. 5008610

PROJECT Olin Chemical Company

DATE 9/23/86

TIME

CALL TO/FROM Mrs. Belmore

REPRESENTING Wilmington Environmental Conservation

PHONE No. (617) 658-4259

SUMMARY OF CONVERSATION:

No information on site-specific activities

Have responded to situations when fires and gas releases have occurred

No knowledge of end. species, or groundwater use

No site specific information

COPIES TO:

BY: DBT

David B. Tompkins

WEHRAN ENGINEERING
CONSULTING ENGINEERS

TELEPHONE CONVERSATION MEMORANDUM

CLIENT Mass DEQE

PROJ. No. 50086.10

PROJECT Olin Chemical

DATE 9/11/86

TIME 11:30 A.M.

CALL TO/FROM Dena Factor

REPRESENTING Hartford Insurance Co.

PHONE No. (617) 726-7550

SUMMARY OF CONVERSATION:

On June 16, 1978 a contractor was overcome by toxic fumes which were venting fumes from the blowing agents used in the manufacturing process. Exposure to the fumes caused his subsequent fall from the roof of the building he was working on.

Case settled on August 4, 1986 out of court. Hartford payment of $946,000 to injured party.

Hartford Case # 334 L 22600
Insured: Stephan Chemical Company

COPIES TO:

BY: David B. Tompkins

David B. Tompkins

WEHRAN ENGINEERING
CONSULTING ENGINEERS

TELEPHONE CONVERSATION MEMORANDUM

CLIENT MDEQE

PROJ. No. 50086.10

PROJECT Olin Chemical Company

DATE 9/23/86

TIME

CALL TO/FROM Peter Dorre

REPRESENTING DWPC

PHONE No. (617) 292-5665

SUMMARY OF CONVERSATION:

DWPC - responsible for all activities other than those affected by RCRA Regulations

DWPC has been involved in remedial activities and plan approvals for reconstructions, groundwater interceptor, monitoring activities, etc.

Upon closure of site, Olin has applied for surface water discharge permit to release treated groundwater. No decision as of yet.

Excavation not deemed feasible due to high volume of material.

Area contaminated by organics, not well defined (around storage tanks).

Inorganics, biggest concern at site is ammonia. Ammonia detected in high concentration in south ditches and interceptor wells.

COPIES TO:

BY: David B. Tompkins

WEHRAN ENGINEERING
CONSULTING ENGINEERS

F. Wlm
~~Alt~~
JAN 17 1983
Adm Ulc

Olin CHEMICALS GROUP

81 EAMES STREET, WILMINGTON, MA 01887

January 12, 1983

Mr. Hans Bonne
The Commonwealth of Massachusetts
Division of Water Pollution Control
One Winter Street
Boston, Massachusetts 02108

Dear Mr. Bonne:

This letter serves as an update on the status of the Remedial Measures Program at the Wilmington plant.

As noted in the Amendment to the Administrative Order, Lagoon No. 2 cleanout has been completed. The schedule for placement of a new liner in Lagoon No. 2 has not been established. Our plan and schedule for installation of the liner system will be submitted to the Division at least 60 days prior to the date we plan to install the liner system.

Operation of the Interceptor Well System continues. We are in the process of finalizing plans for installation of a pump to include Well 2A in the Interceptor Well System. In addition, we are in the process of completing plans for installation of the skimming system for removal of the organic materials collected in the separation tank.

The excavation of contaminated soil along the East Drainage Ditch was completed on December 10. The contaminated soil was shipped off-site for disposal in the hazardous waste landfill of SCA Inc. in Model City, New York. The excavated soil was replaced with clean stone. We will maintain the absorbent barriers along the East Drainage Ditch and continue to maintain routine observations of the area.

Replacement of five manholes in the in-plant non-sulfate sewer line under the Phase I program was completed on December 30, 1982. Repairs to two sections of broken sewer line were completed on December 30, 1982 and the third section was completed January 7. In addition to the scheduled repairs under Phase I, repairs were also made to several sections of the in-plant sulfate process sewer line. We are now in the process of developing a plan and schedule for Phase II repairs which will be submitted to your office by February 28, 1983.

The fourth quarter sampling and analysis of sixteen existing wells and four surface water stations for the parameters shown in Table I of the Amendment was completed on October 20-21, 1982. Results of this monitoring program are included in attached

Tables 1 and 2. It is too soon to show any significant changes in the groundwater quality due to implementation of our remedial measures. We will continue the monitoring program in 1983 with sampling to be conducted in the second and fourth quarters.

If additional information is required on any of the above, please contact Mr. James Martucci at 617/933-4240 or David Vaughn at 615/336-4556.

Sincerely,

OLIN CORPORATION

Ronald J. McBrien

Ronald J. McBrien
Plant Manager

RJMc/bab
Attachment

cc: M.R. Sokolowski, Olin-Stamford

F. Wilm
Groundwater

UMV
MBS
RJM
MDT
MCA

Olin CHEMICALS GROUP
P.O. BOX 248, CHARLESTON, TENNESSEE 37310, (615) 336-2251

July 2, 1982

RECEIVED
JUL 02 1982
V. NORWOOD

Mr. Hans Bonne, P.E.
The Commonwealth of Massachusetts
Division of Water Pollution Control
One Winter Street
Boston, Massachusetts 02108

Dear Mr. Bonne:

On March 18, 1982, a report on the four-season "Hydrogeologic Investigation" of the Olin-Wilmington facility was submitted to the Massachusetts Division of Water Pollution Control. A proposed schedule for implementation of the recommended remedial measures was included with the March 18 letter. Although the proposed implementation schedule has not been fully approved, the following is provided as an update on the status of the remedial measures outlined in the schedule.

An Engineering Plan for the Interceptor Well System was submitted to your office on March 25, 1982. The Plan was approved by a letter dated April 20 subject to several provisions, one of which was that approval be acquired from the Metropolitan District Commission for discharge of the effluent to the MDC system. The MDC did not rule in favor of this discharge. This has resulted in a delay of implementation of this remedial measure. Installation of the Interceptor Well System has been completed, however, the ultimate deposition of the discharge from the System is still under evaluation. A revision of the Plan outlining the result of this evaluation and addressing additional provisions outlined in your letter of April 20 will be addressed in a separate letter when the revised plans are complete.

A plan for the remedial measure "Excavation Along East Ditch" was submitted to your office on May 3. A preliminary meeting was held with the Boston & Maine Railroad on May 25. A detailed plan will be submitted to the BMRR and the Massachusetts Bay Transit Authority in July for approval to perform the work outlined in the plan. This remedial measure should not proceed until the Interceptor Well System is in operation.

A "Purchase Requisition" for cleaning and TV inspection of the in-plant process sewer lines was initiated on May 5. A contract was issued to New England Pipe Cleaning Company on May 7 for this work. An attempt was made to conduct the cleaning and inspection program during the weekend of June 4-6 but was delayed due to extremely heavy rainfall. The cleaning and inspection of the in-plant sewer lines is now scheduled to be completed during the annual plant shutdown (July 5-16, 1982). A plan for necessary repairs will be developed after receipt and review of the results of the inspection program.

Mr. Hans Bonne
Page 2
July 2, 1982

A fourth remedial measure "Lagoon No. 2 Cleanout and Repair" is scheduled for September, 1982. Dewatering of Lagoon No. 2 was initiated on May 8. It is necessary to allow a period of drying to improve the handling of the sludge within the lagoon. Replacement of the liner in Lagoon No. 2 is scheduled for June-July, 1983.

I would also like to confirm our meeting scheduled for July 22 to review the "Hydrogeologic Investigation" Report as well as the progress on the remedial measures. If there are any questions on the above, please contact me at 617/933-4240.

Sincerely,

OLIN CORPORATION

David R. Vaughn

David R. Vaughn
Manager, Regional Environmental Affairs

DRV/vrp

F/s file Oli [redacted]
Wilmington

Olin CHEMICALS GROUP

51 EAMES STREET, WILMINGTON, MA 01887

NORTHEAST REGION

October 20, 1982

OCT 29 1982

DEPT. OF ENVIRONMENTAL QUALITY ENG.

Mr. Chester Bruce
Wilmington Conservation Commission
Town Hall - Middlesex Avenue
Wilmington, MA 01887

Dear Mr. Bruce:

Enclosed are a completed "Notice of Intent" and "Environmental Data Form" for the proposed excavation of the East Ditch adjacent to the Olin-Wilmington plant.

The project involves the removal of contaminated soil from an area approximately three (3) feet wide and approximately 100 feet long at the edge of the ditch. The soil will be replaced with crushed stone along this section of the ditch. Approximately twenty (20) cubic yards of soil will be removed.

This contaminated soil is the result of past activities at the Wilmington plant prior to ownership by Olin. We have been working with the Massachusetts Division of Water Pollution Control to develop remedial measures for this area. They have approved the plan we developed.

We propose to perform this work in November. It is estimated it will require two to six days to complete. A siltation barrier and an adsorbent boom will be utilized to control silt or organic chemicals released during construction.

We would appreciate your prompt review and approval of this proposed project to allow implementation in November. If there are any questions, please contact me at 933-4240.

Sincerely,

OLIN CORPORATION

Ronald J. McBrien

Ronald J. McBrien
Plant Manager

RJM/bab

cc: DEQE - Woburn
E. Romano, Town of Wilmington
Hans Bonne MDWPC

WETLANDS PROTECTION ACT

MAS CHUSETTS G.L. C. 131 s. 40

NOTICE OF INTENT

All parts of this form and the attached Environmental Data Form shall be completed under the pains and penalties of perjury. Incomplete filings may be rejected.

DATE: 10/21/82

Conservation Commission of (City/Town): Wilmington

1. Notice is hereby given in accordance with the provisions of Massachusetts G.L. c. 131, s. 40 that the proposed activity described herein is within the jurisdiction of

(City/Town) Wilmington, at 51 Eames Street

Most recent recording at the Registry of Middlesex County, Book 317,

Page 35.

Certificate (if registered) not available.

2. The land on which the work is proposed to be done is owned by:

NAME(s) Massachusetts Bay Transportation Authority ADDRESS 50 High Street Boston, MA 02110

3. The Applicant submitting this Notice is:

NAME Olin Corporation R. J. McBrien ADDRESS 51 Eames Street, Wilmington

TELEPHONE (617) 933-4240

(Optional) The following person is hereby designated to represent the applicant in matters arising hereunder:

Name M. D. Townley Address 51 Eames Street, Wilmington

Telephone (617) 933-4240

4. Plans describing and defining the work, included herewith and made a part hereof, are titled and dated:

Olin Drawing No. D-P049-200, East Ditch Clean-up, Project Construction Site Plan and Pro

5. Identical material has been submitted by certified mail as follows:

5 copies to Conservation Commission

Original to Conservation Commission (Date) 10/20/82

Three copies to appropriate regional office of the Department of Environmenta Quality Engineering (see map for regions and addresses). Date 10/20/82

Northeast X Southeast ____ Central ____ Western ____

NORTHEAST REGIONAL
Department of Environmental Quality Engineering
Box L029.. ..

6. Has the required $25.00 filing fee, payable to the city or town, been included with the submission to the Conservation Commission? yes

7. Has the Environmental Data Form been completed and submitted with each copy? yes

8. Has a locus map (8½" x 11" copy of USGS topographic sheet with the site marked) been included with each copy? yes

9.
(A) Have all obtainable permits, variances, and approvals required by local by-law been obtained? yes

(B) If they have not been obtained, have they been applied for? ______
If yes, include with this Notice of Intent any information which has been submitted with such applications which is necessary to describe the effect of the proposed activity on the environment.

10.
(A) Is the site of the proposed work subject to a wetland restriction order recorded pursuant to G.L. c. 131, s. 40A, or G.L. c. 130, s. 105, by the Department of Environmental Management? Yes X No ______ Do not know ______

(B) Is the site of the proposed work in, or within 100 feet of: a coastal dune N/A; coastal bank ____; coastal beach ____; salt marsh ____; land under the ocean ____; a salt pond ____; anadromous/catadromous fish run ____; do not know ____?

11. Signature(s) of owner(s) of the land (if by agent or option holder, written authorization must be attached) see attached letter of approval

12. What is the purpose of the proposed project?

To remove soil from the bank along the East Drainage Ditch and replace with crushed stone.

13. I HEREBY CERTIFY UNDER THE PAINS AND PENALTIES OF PERJURY THAT THE FORGOING NOTICE OF INTENT AND ACCOMPANYING ENVIRONMENTAL DATA FORM ARE TRUE AND COMPLETE.

Ronald J. McBrie
Signature of Applicant

~~10/21/82~~ 10/28/82
Date

WETLAND PROTECTION ACT

ENVIRONMENTAL DATA F M

1. All parts of this form are to be filled out by the applicant or his agent under the provisions of G.L. C. 131 s. 40.

2. Where a section is not relevant to the application in question, the words "Not Applicable" should be entered on the appropriate line.

NAME OF APPLICANT
Olin Corporation

ADDRESS OF APPLICANT 51 Eames Street, Wilmington, MA 01887

MUNICIPALITIES WHERE ACTIVITY IS PROPOSED AND NOTICE IS FILED
Wilmington

DESCRIPTION OF PROPERTY INVOLVED IN APPLICATION (including the dimensions of any existing buildings, decks, marinas, existing cesspools)
Drainage ditch and adjoining bank along MBTA railroad tracks

DESCRIPTION OF MODIFICATIONS PROPOSED ON THE SITE, including grading, dredging, removal of vegetation, etc.
Contaminated soil will be removed from the bank along the East Ditch and will be replaced with crushed stone as shown on Drawing No. D-P044-200.

A. SOILS

1. United States Department of Agriculture Soil Types (show on map)
Sandy type soil

---

2. Permeability of soil on the site. (Dates of testing)
N/A

---

3. Rate of percolation of water through the soil. (Dates of testing)
N/A

B. SURFACE WATERS

1. Distance of site from nearest surface water (Date of measurement)
Edge of drainage ditch

---

2. Sources of runoff water
Olin plant site and MBTA railroad track and right of way and area north of Eames Street bridge.

3. Rate of runoff from the site
No change - average flow measured in the East Ditch at Eames Street in 1981 was 0.18 MGD with a range of 0.04 to 0.23 MGD.

4. Destination of runoff water
East Drainage Ditch flows to Halls Brook approximately 0.9 miles to south.

5. Chemical additives to runoff water on the site
Run-off water during construction may contain small quantities of organic chemicals due to removal of contaminated soil. Adsorbent booms will be placed across the ditch to intercept any floating organic material.

C. GROUND COVER

1. Extent of existing impervious ground cover on the site
None

2. Extent of proposed impervious ground cover on the site
None

3. Extent of existing vegetative cover on the site
Minimal

4. Extent of proposed vegetative cover on the site
None

D. TOPOGRAPHY

1. Maximum existing elevation on site
87.6'

2. Minimum existing elevation on site
77.08

3. Maximum proposed elevation of site
Same
87.6'

4. Minimum proposed elevation of site
Same
77.08'

5. Description of proposed change in topography
No change in topography

E. GROUND WATER

1. Minimum depth to water table on site (at time of filing)
water table at water level of ditch

2. Maximum depth to water table on site (at time of filing)
water table at water level of ditch

F. WATER SUPPLY

1. The source of the water to be provided to the site
N/A

2. The expected water requirements (g.p.d.) for the site
N/A

3. The uses to which water will be put
N/A

G. SEWAGE DISPOSAL

1. Sewage disposal system (description and location on the site, of system)
N/A

2. Expected content of the sewage effluents (human waste, pesticides, detergents, oils, heavy metals, other chemicals)
N/A

3. Expected daily volume of sewage
N/A

H. SOLID WASTE

1. Estimated quantity of solid waste to be developed on the site
20 cu. yds.

2. Method for disposal of solid waste
Off-site approved landfill

3. Plans for recycling of solid waste
None

I. BOAT YARDS, DOCKS, MARINAS

1. Capacity of marina (number of boats, running feet)
N/A

2. Description of docks and floats (site, dimensions)
N/A

3. Description of sewage pumpout facilities (type of waste disposal)
N/A

4. Description of fueling facilities and fuel storage tanks
N/A

5. Description of fuel spill prevention measures and equipment
N/A

J. IMPACT OF PROPOSED ACTION APPLIED FOR

1. Effects on plant species (upland and marine)
None

2. Effects on marine species (shellfish, finfish)
None

3. Effects on drainage and runoff
None

4. Effects on siltation of surface waters
Resulting crushed stone surface will reduce potential for siltation. A siltation barrier will be used during construction.

5. Effects on groundwater quality
None

6. Effects on surface water quality
None

K. ALTERNATIVES TO PROPOSED ACTION

1. Describe alternatives to the requested action

None

2. Describe the benefits of the requested action over the alternatives

N/A

Imprazy Permit - Massachusetts P# 1582-73
David R. Vaughn
9/12/82

1	.3048
2	.6096
3	.9144
4	1.2192
5	1.5240
6	1.8288
7	2.1336
8	2.4384
9	2.7432
10	3.0480

To convert feet to meters multiply by .3048

To convert meters to feet multiply by 3.2808

(BOSTON NORTH)
6769 I NE

ROAD CLASSIFICATION

Heavy-duty — Light-duty

Medium-duty — Unimproved dirt

Interstate Route — U.S. Route — State Route

QUADRANGLE LOCATION

WILMINGTON, MASS.

N4230—W7107.5/7.5

1965

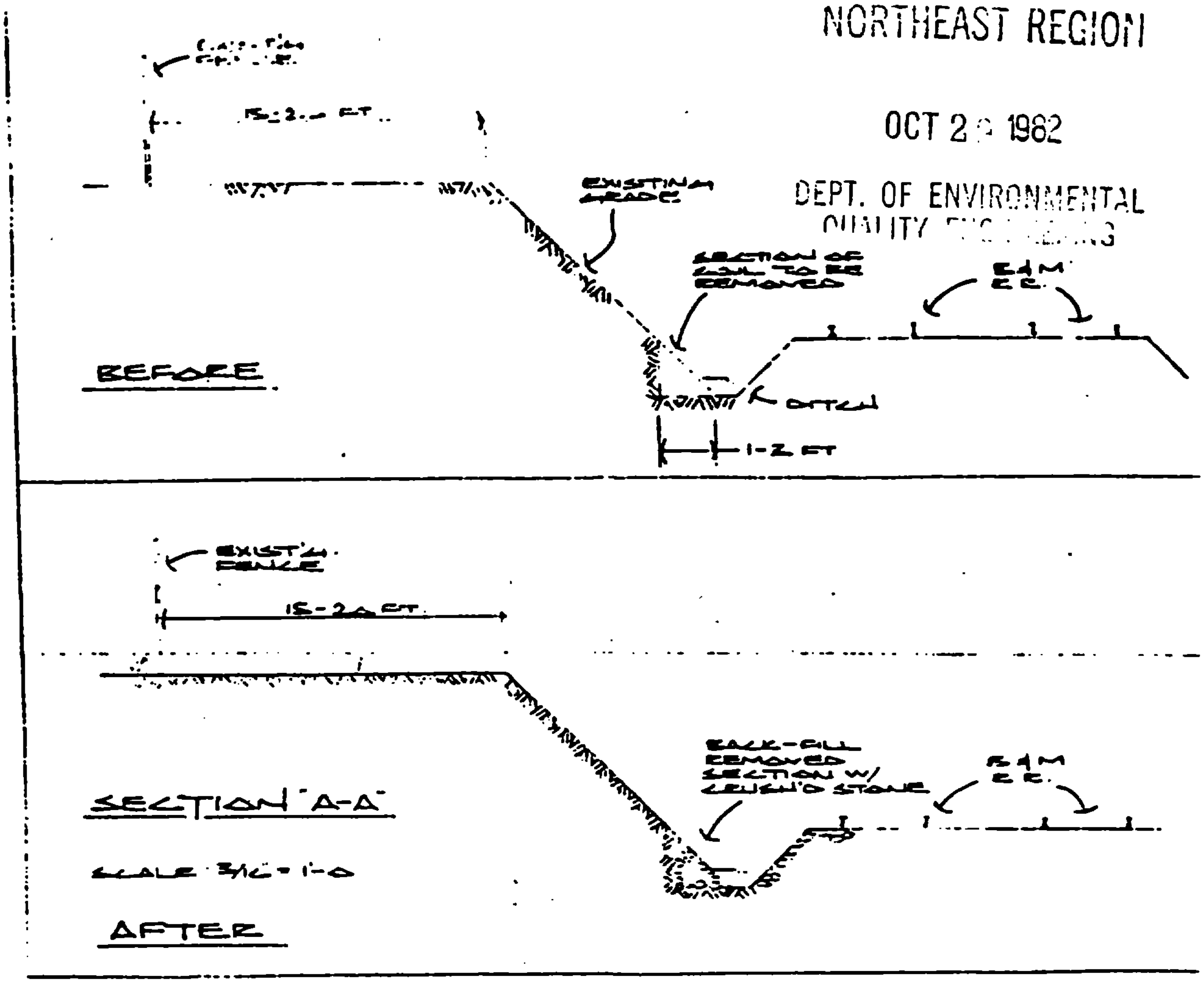
PHOTOREVISED 1979

AMS 6769 II SW—SERIES V814

NORTHEAST REGION

OCT 2? 1982

DEPT. OF ENVIRONMENTAL QUALITY ENGINEERING



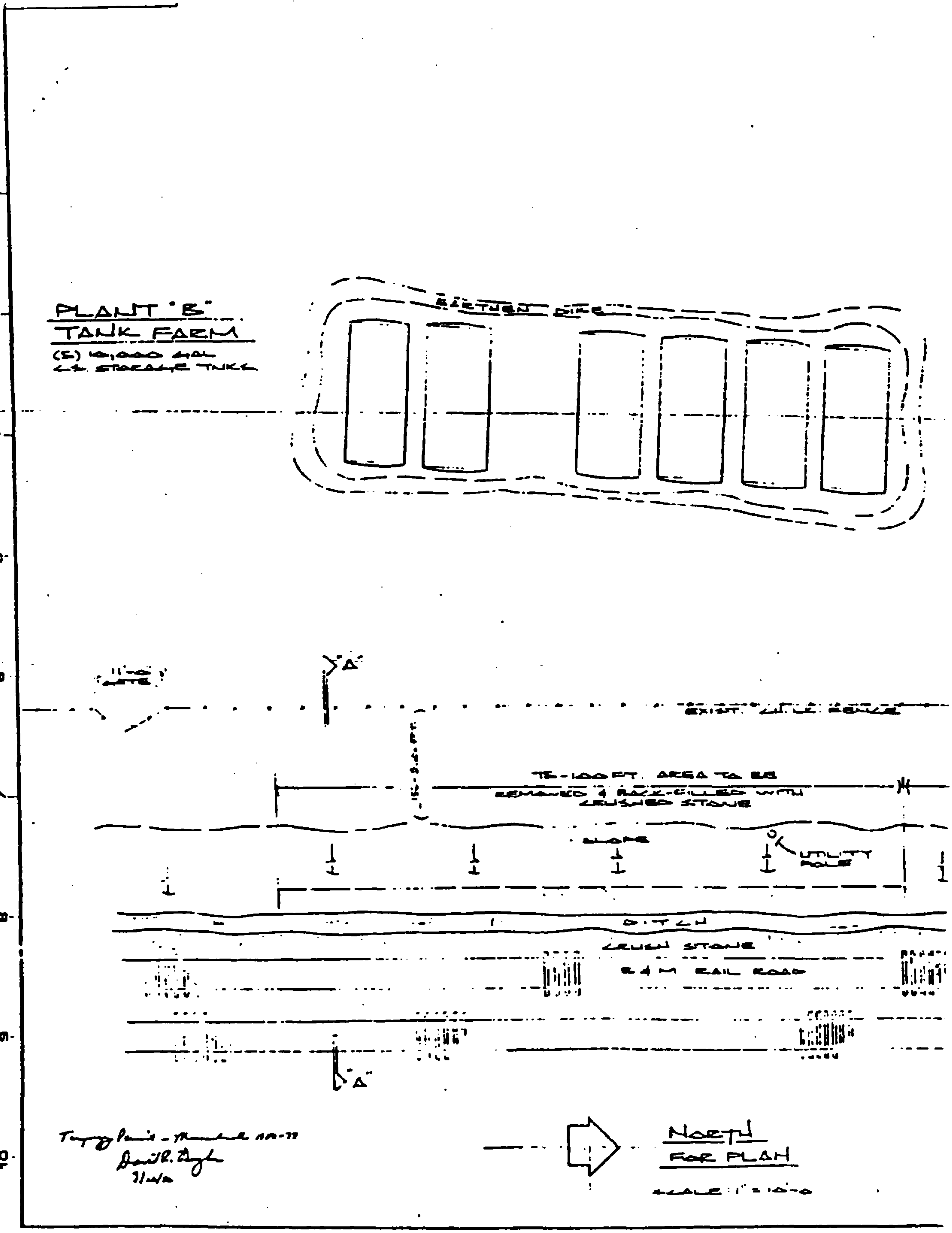
ISSUED FOR REVIEW

OLIN/WILMINGTON
SEP 1 6 1982
ISSUED

Olin
CHEMICALS GROUP
WILMINGTON, MA.

EAST DITCH CLEAN-U
PROJECT-CONSTRUCTI
SITE PLAN AND PROFI

D-F043-200



PLANT "B"
TANK FARM
EARTHEN DIKE
SLOPE
UTILITY POLE
DITCH
NORTH
FOR PLAN

copy Dick Brian Pete BK

The Commonwealth of Massachusetts

Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
100 Cambridge Street, Boston 02202

ANTHONY D. CORTESE
COMMISSIONER

MEMORANDUM

NORTHEAST REGION

JUL ... 1980
DEPT. OF ENVIRONMENTAL QUALITY ...

File

TO:	Dick Chalpin, DHW
	Peter Dory, DWPC
	Jerry Buzanoski, DWPC
	Donovan Bowley, DEQE
	Al Ferullo, MDC Met. District Comm.
	Bob Cleary, DAQC
	Rick Leighton, EPA
FROM:	Madeline Snow, DEQE MS
DATE:	June 30, 1980
RE:	Field Trip--Stepan Chemical Co., Wilmington, & Environs

On June 25, 1980 I took a summer intern and another staff person on a brief "tour" of the Aberjona River (Upper Mystic Lake Watershed). The purpose of the field trip was to familiarize these two individuals with the Watershed and to investigate some of the stormwater discharges as part of our urban runoff project.

We also walked both the east and west sides of Stepan Chemical Company in Wilmington and I thought you might be interested in a few notes of the trip. (Please refer to attached map.) Some of this information was obtained from the aerial photographs taken under the Surface Impoundments Assessment Program; a set of these are available at the DEQE Regional Office in Woburn.

1. There still was a heavy chemical odor and a slick/sheen surface to the water in the ditch running on the east side of the RR tracks along Raffi & Swanson Chemical Company (#1). This condition has been noted by various people since May of 1979.

2. There was oil seeping from the shore on the west side of the RR tracks parallel to the storage tanks of Stepan Chemical Company (#2). Because the water level in the ditch was much lower than on previous visits, it was very visible that the ground was saturated with oil. This condition has also been reported by various people.

   From MDC records, Stepan has the following materials being stored at the site. Please note that it is unclear as to which of these storage tanks are the ones in question.

	MATERIAL BEING STORED	Annual Thruput (gals.)	TYPE OF STORAGE CONTAINER (tank, drum, etc.)	Size of Container (gals.)
1.	Formaldehyde	172,500	Tank	13,300
2.	Nonyl phenol	281,600	Tank	10,000
3.	Dinonyl phenol	30,500	Tank	6,700
4.	Ethyl hexoic acid	18,400	Tank	5,000
5.	Dioctylphthlate	54,200	Tank	15,000
6.	Process Oil	11,800	Tank	4,250
7.	TNPP (Wytox 312)	50,000	Tank	10,000

At the May 13, 1980 sampling run by DWPC a sample of the material was collected and analyzed for oil and grease at the Lawrence Experiment Station. The results were 1710 mg/l. No other analyses for this material were made.

3. The discharge from the Stepan north and south drainage ditches was only flowing slightly (#3). The odor of chemicals was very noticeable. With all the vegetation growth in the last month the "path" of dead trees/bushes along the ditches on Stepan's property is very noticeable.

4. On the west side of Stepan Chemical, off Jewell Drive, the following was found:

   The paved portion of Jewell Drive ends south of Hardwick Chemical Corporation (#4). Following the unpaved portion of the road, one comes upon a cul de sac in an undeveloped area (#5) with an open manhole and pipe which discharges into a large ditch. The water in the ditch was of an unnatural odor/color. Similarly, on the other side of the cul de sac there is another manhole (covered with wooden planking and weighted down with a stone) and a pipe which discharges into a marshy area (#6).

   These ditches, particularly the former, may be contributing sources to the overall pollution in the area.

   It appears that the following should now be done in order to complete the investigation of the area:

   a. Field investigations of both JBF Scientific Corporation and Hardwick Chemical Corporation. Aerial photographs reveal what would appear to be a swimming pool on JBF Scientific's property; this should be checked.

b. Field investigation of the cul de sac, roads, manholes, discharge pipes, ditches and marshes.

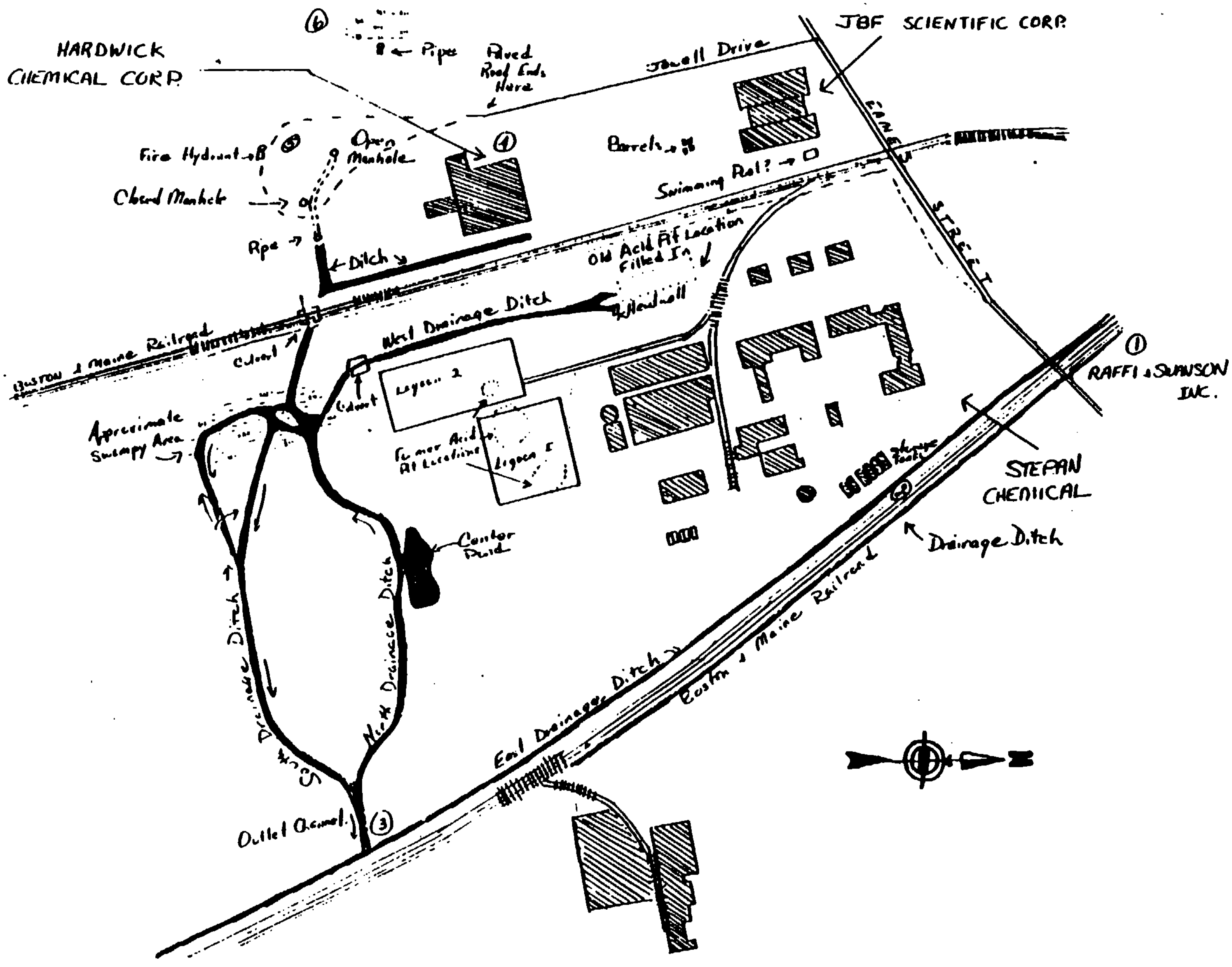
c. Field investigation of connection between the ditches near Hardwick and Stepan's property.

d. Check on Raffi and Swanson's operation and Poly-vinyl Chemical north of Raffi & Swanson.

e. Organic chemical analyses as warranted.

I hope this information is of assistance to you.

MS/ecw



HARDWICK CHEMICAL CORP.
JBF SCIENTIFIC CORP.
Jewell Drive
Pipe
Paved Road Ends Here
Fire Hydrant
Open Manhole
Closed Manhole
Pipe
Ditch
Barrels
Swimming Pool?
Old Acid Pit Location Filled In
Headwall
West Drainage Ditch
Boston & Maine Railroad
Culvert
Culvert
Lagoon 2
Former Acid Pit Location
Lagoon 1
Approximate Swampy Area
Center Pond
North Drainage Ditch
Drainage Ditch
Outlet Channel
East Drainage Ditch
Boston & Maine Railroad
STEPAN CHEMICAL
RAFFI & SWANSON INC.
Drainage Ditch
1
2
3
4
5
6

The Commonwealth of Massachusetts 6/15/8

Department of Environmental Quality Engineering

Metropolitan Boston - Northeast Region

323 New Boston Street, Woburn, MA 01801

ANTHONY D. CORTESE, Sc.D.
Commissioner
727-5194

XC: MT

Rec'd 12/5/83 RMC

November 21, 1983

Olin Chemicals Group
51 Eames Street
Wilmington, MA 01887

Attention: Mr. Ronald J. McBrien

RE: Wilmington-Met. Boston/Northeast Region
310 CMR 7.02 - Plans Approval
Appl. No. MBR-82-IND-023
Reporting Requirements
MODIFIED INTERIM APPROVAL

Gentlemen:

The Metropolitan Boston/Northeast Region of the Department of Environmental Quality Engineering is hereby revising the INTERIM APPROVAL granted to the Olin Chemical Group on November 23, 1982 which permitted the burning of a waste alcohol mixture with the following typical composition:

"50-60% Methanol, 25-30% Butanol, 2-10% Benzophenone, 2-10% Benzophenone Hydrazone, 1-3% Water, 0 -0.5% Azone, and 0-2% Diphenyl Methanol."

The Department has reviewed the monthly laboratory analyses which the Olin Chemicals Group has been submitting, and has decided that a revised typical analysis is called for to better reflect the actual waste alcohol mixture being burned. Accordingly, the third paragraph of the original INTERIM APPROVAL letter is being deleted, and replaced with the following language:

> "The waste alcohol mixture will contain no more than 30% water. The remaining constituents will be a combination of the following alcohols: Methanol, Butanol, Benzophenone, Benzophenone Hydrazone,Azone, and Diphenyl Methanol."

The Department is also in receipt of a second request to rescind the requirement for an "independent laboratory analysis..."as stated in Proviso 6 of the original INTERIM APPROVAL letter. The Department has considered this request, and is hereby superceding the original Proviso 6 with the following language:

6. That a written monthly report including the results of analyses performed by the Olin Chemicals Group be submitted to this office. This report must also state the daily quantity of waste alcohol mixture and the daily quantity of No. 6 fuel oil fired into the Unit Number 1 boiler.

Also, every sixth report must include an independent laboratory analysis of the waste alcohol mixture. All of the laboratory analyses must provide sufficient detailed information to confirm that the waste alcohol mixture is in compliance with Proviso Number 4.

In addition, the following paragraph should be inserted after Proviso Number 7:

"This INTERIM APPROVAL is in conformance with the requirements of Regulation 310 CMR 30.356(4) in that the waste alcohol mixture is not a hazardous material when combusted in compliance with the terms of this approval".

Please be advised that the changes made by this letter are the only modifications to the original INTERIM APPROVAL dated November 23, 1982, and that all other provisions and conditions of the original INTERIM APPROVAL letter remain in effect.

Please contact Mr. Richard Chalpin, Deputy Regional Environmental Engineer of my staff with questions concerning the Regulation 310 CMR 30.356(4), or Mr. Michael J. Maher, Regional Air Quality Section Chief with any questions concerning the other revisions contained in this letter.

Very truly yours,

William J. St. Hilaire

William J. St. Hilaire, P.E.
Regional Environmental Engineer

WJSH/tm

cc: Board of Health
Fire Department
DAQC - Eng. Br.
Olin Corp., P.O. Box 248, Lower River Road, Charleston, TN 37310
Mr. Chalpin
Mr. Maher

Olin CHEMICALS

120 LONG RIDGE ROAD, STAMFORD, CONNECTICUT 06904

April 27, 1984

Ms. Nancy Wrenn
Division of Hazardous Waste
DEQE
One Winter Street
Boston, MA 02108

Re: Revised Hazardous Waste Permit Application
Olin Corporation - Wilmington Plant
EPA I.D. No. MAD001403104

Dear Ms. Wrenn:

Please find attached revised Forms 1 and 3 for Olin Corporation's Wilmington, Massachusetts plant. Since the original submission on November 17, 1980, Olin Corporation has submitted two revisions to its RCRA Part A permit application. The first was submitted on January 26, 1983 and in a letter dated March 17, 1983 from the USEPA it was indicated that the amendment had been incorporated into our file. The second amendment was submitted on June 30, 1983 (copy attached) requesting the removal of two 15,000-gallon storage tanks and is currently under review. When the June 30, 1983 request is approved, the facility will have two drum storage units and one storage tank unit remaining at the facility.

The purpose of today's request is to allow for the movement of the storage tank to a diked area meeting the requirements of Mass. 310 CMR 30.694 for secondary containment of above ground storage tanks. Due to space limitations, it is not feasible to upgrade the current containment area to provide for 110% volume of the tank as required in 310 CMR 30.694. Therefore, Olin Corporation requests that its Part A interim status application be revised as provided for in 310 CMR 30.099(2) which allows modification of interim status permits when such modification does not constitute an increase in design capacity.

We wish to also take this opportunity to make some clerical and administrative revisions to our interim status permit. These include:

Form 1, Item X, A - Since the original submission, the plant has been issued an NPDES permit and the number is reflected in this section.

Form 1, Attachment 1, Existing Environmental Permits - This section has been updated to reflect existing permit status.

IV, Line 6, Page 3 of 5 - The designation of storage of this material in S02, tanks, has been removed. This designation should have been removed when the request to remove the two 15,000-gallon storage tanks was submitted on June 30, 1983. These storage tanks were never used for hazardous waste storage.

Ms. Nancy Wrenn
Page 2
April 27, 1984

Form 3, Item IV, Line 8, Page 3 of 5 - The estimated annual quantity of this material has been changed from 45 tons to 250 tons. The primary uses of this material, by-product HCl, is for use as a feedstock in another production process and neutralization of other waste streams at the facility. On occasions when market demand for products is reduced, some of this material is neutralized and discharged through our MDC-permitted treatment facility. Therefore, the annual amount of this material can vary dramatically.

Form 3, Item V, Page 5 of 5 - The facility drawing has been revised to show the new location of the bulk storage tank.

For your convenience, a complete Form 1 and Form 3 are being submitted to be inserted into our file. This revised application supercedes all previous submissions except to the extent that previous submissions established timely compliance.

We would appreciate your assistance in acting on this revision expeditiously as we are prepared to move the tank to the upgraded containment area upon written approval from your department. As always, your cooperation is appreciated and should you have any questions concerning today's revisions, please do not hesitate to contact Mr. J. W. O'Grady at 615/336-4541.

Sincerely,

OLIN CORPORATION

F. A. Eakin
Vice President
Manufacturing & Engineering

FAE/JWO/vrp

cc: Mr. Jacob Edwards
Date Waste Programs
U. S. Environmental Protection Agency
Room 1903
J.F.K. Federal Building
Boston, Massachusetts 02203

[redacted]
323 New Boston Street
Woburn, MA 01801

MBS 5/27

Please print or type in the unshaded areas only
(fill—in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-R0175

FORM 1 GENERAL

EPA

ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

F MAD001403104

LABEL ITEMS

I. EPA I.D. NUMBER

III. FACILITY NAME

V. FACILITY MAILING ADDRESS

VI. FACILITY LOCATION

PLEASE PLACE LABEL IN THIS SPACE

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill—in area below. Also, if any of the preprinted data is absent (the area to the left of the label space lists the information that should appear), please provide it in the proper fill—in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI (except VI-B which must be completed regardless). Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold—faced terms.

SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED
A. Is this facility a publicly owned treatment works which results in a discharge to waters of the U.S.? (FORM 2A)		X		B. Does or will this facility (either existing or proposed) include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to waters of the U.S.? (FORM 2B)		X	
C. Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)	X		No	D. Is this a proposed facility (other than those described in A or B above) which will result in a discharge to waters of the U.S.? (FORM 2D)		X	
E. Does or will this facility treat, store, or dispose of hazardous wastes? (FORM 3)	X		Yes	F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
I. Is this facility a proposed stationary source which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X		J. Is this facility a proposed stationary source which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	

III. NAME OF FACILITY

1 SKIP OLIN CORPORATION

IV. FACILITY CONTACT

A. NAME & TITLE (last, first, & title)	B. PHONE (area code & no.)
McBRIEN RONALD J. PLANT MGR.	617 933 4240

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX

3 51 EAMES STREET

B. CITY OR TOWN	C. STATE	D. ZIP CODE
WILMINGTON	MA	01887

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER

5 51 EAMES STREET

B. COUNTY NAME

MIDDLESEX

C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE (if known)
WILMINGTON	MA	01887	

EPA Form 3510-1 (6-80)

CONTINUE ON REVERSE

Olin Corporation
Wilmington, Massachusetts Plant
MAD001403104

FORM 1 - ATTACHMENT 1 (Revised 4/27/84)

II.C.: Forms 1 and 2C were submitted on May 5, 1982.

II.E.: Original Forms 1 and 3 were submitted on November 17, 1980.

X. Existing Environmental Permits

1. Letter of Approval to Operate Sanitary Landfill dated January 9, 1975.
2. Industrial User Discharge Permit, Metropolitan District Commission, Dated July 7, 1982.
3. Letter of Approval to Construct Gypsum Storage Lagoon No. 1, dated July 16, 1971.
4. Letter of Approval to Construct Gypsum Storage Lagoon No. 2, dated September 10, 1973.
5. Letters of Approval to Construct Bag Collection Systems dated July 12, 1983 and July 18, 1974.
6. Letters of Approval to Construct and Operate an Air Scrubber dated October 20, 1982 and July 28, 1983.

Please print or type in the unshaded areas only
(fill-in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-S80004

FORM 3 RCRA — EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY
HAZARDOUS WASTE PERMIT APPLICATION
Consolidated Permits Program
(This information is required under Section 3005 of RCRA.)

I. EPA I.D. NUMBER

F | M A D 0 0 1 4 0 3 1 0 4

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below *(mark one box only)* to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION *(place an "X" below and provide the appropriate date)*

☐ 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

☐ 2. NEW FACILITY *(Complete item below.)*

C 8 | YR. | MO. | DAY | FOR EXISTING FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

YR. | MO. | DAY | FOR NEW FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR IS EXPECTED TO BEGIN

B. REVISED APPLICATION *(place an "X" below and complete Item I above)*

☒ 1. FACILITY HAS INTERIM STATUS

☐ 2. FACILITY HAS A RCRA PERMIT

III. PROCESSES – CODES AND DESIGN CAPACITIES

A. PROCESS CODE – Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process *(including its design capacity)* in the space provided on the form *(Item III-C)*.

B. PROCESS DESIGN CAPACITY – For each code entered in column A enter the capacity of the process.
1. AMOUNT – Enter the amount.
2. UNIT OF MEASURE – For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER *(barrel, drum, etc.)*	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER *(Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)*	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G	LITERS PER DAY	V	ACRE-FEET	A
LITERS	L	TONS PER HOUR	D	HECTARE-METER	F
CUBIC YARDS	Y	METRIC TONS PER HOUR	W	ACRES	B
CUBIC METERS	C	GALLONS PER HOUR	E	HECTARES	Q
GALLONS PER DAY	U	LITERS PER HOUR	H		

EXAMPLE FOR COMPLETING ITEM III *(shown in line numbers X-1 and X-2 below)*: A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

C | DUP | T/A | C 1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S 0 2	600	G		5				
X-2	T 0 3	20	E		6				
1	S 0 1	17,390	G		7				
2	S 0 2	10,310	G		8				
3					9				
4					10				

Continued from page 2.
NOTE: Photocopy this page before completing u have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1)	T/A	C	FOR OFFICIAL USE ONLY	T/A	C	
W MAD001403104		1	W DUP		2	DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)				D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	P105	250	P	S01				
2	U028	5000	P	S01				
3	U154	1000	P	S01				
4	D008	9	T	S01				
5	D001	15	T	S01				
6	D001	13	T	S01				
7	U028							Included with above
8	D002	250	T	S02	T01			
9	M001	6700	P	S01				
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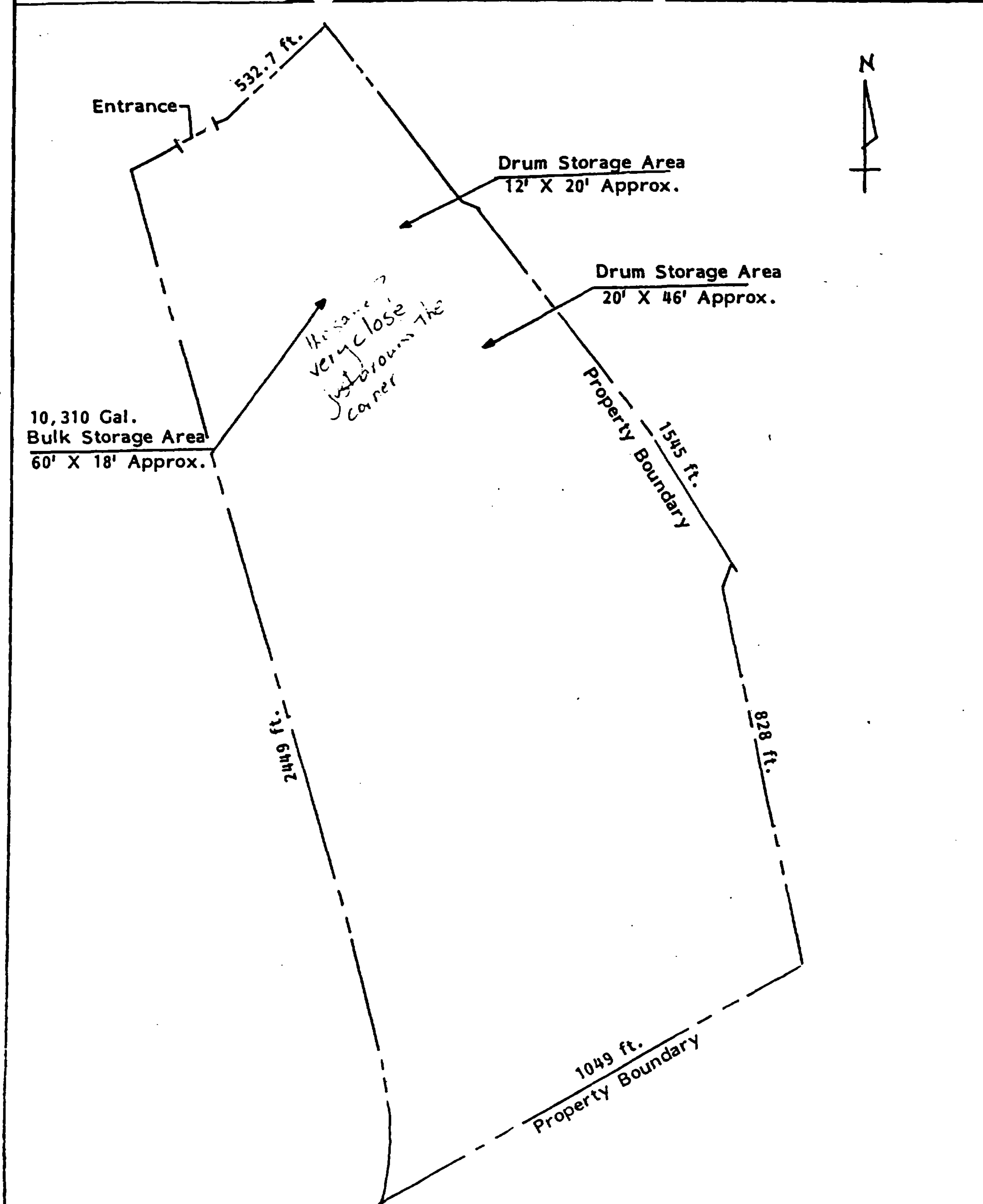
Continued from page 4.
Form Approved OMB No. 158-S80004

V. FACILITY DRAWING *(see page 4)*



Olin CHEMICALS GROUP
120 LONG RIDGE ROAD, STAMFORD, CT 06904

WILLIAM A. OPPOLD
Senior Vice President
Manufacturing and Engineering

June 30, 1983

Mr. William Cass, Director
Division of Hazardous Waste
Department of Environmental
Quality Engineering
Commonwealth of Massachusetts
One Winter Street
Boston, MA 02108

Re: Revised Hazardous Waste Permit Application
Olin Corporation-Wilmington Plant
EPA I.D. No. MAD001403104

Dear Mr. Cass:

On November 17, 1980, Olin Corporation submitted a RCRA permit application, (i.e., Forms 1 and 3) for its Wilmington, Massachusetts plant. This original submission was revised on January 26, 1983. Today, we are revising our application in order to remove two 15,000-gallon storage tanks. These tanks were included in our original submission to store RCRA hazardous wastes. However, these tanks were never used for the storage of hazardous wastes and the need to keep these tanks available for hazardous wastes storage no longer exists. Form 3, Part III, A and B, Page 1 of 5, has been revised to delete S02, 30,000 G,. Also on Page 5 of 5, we have removed the 30,000-gallon bulk storage area shown in the northern corner of the property. For convenience, an entire Form 3 is being submitted and should be inserted in our file. This revised application supercedes all previous submissions except to the extent that previous submissions establish timely compliance.

Thank you for your assistance in this matter and if there are any questions concerning the above changes, please contact Mr. J. W. O'Grady at 615/336-4541.

Sincerely,

OLIN CORPORATION

W. A. Oppold

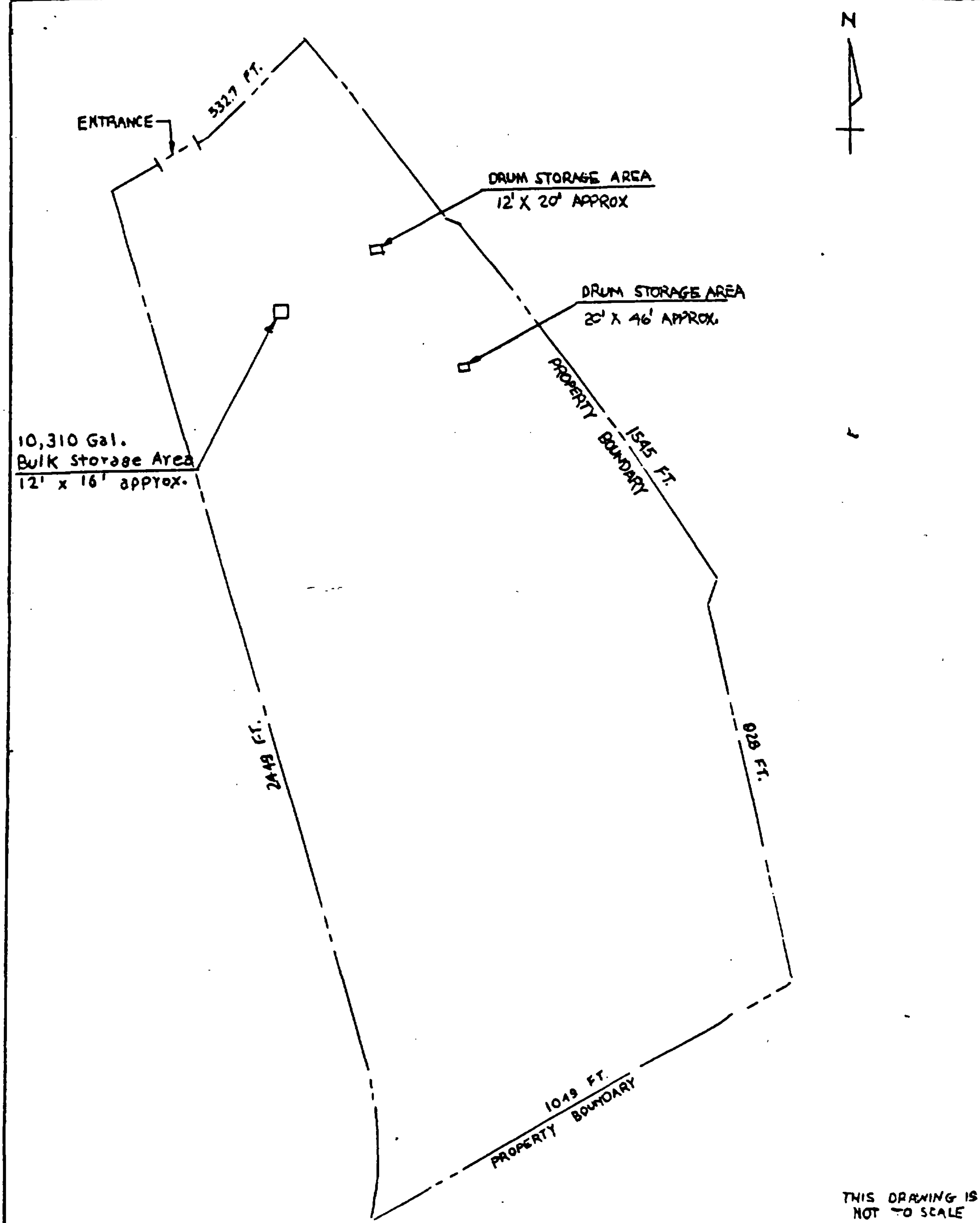
WAO/JWO/vrp HBD 7/5/83

cc: U. S. Environmental Protection Agency
Region I
Permits Branch
P. O. Box 8748
Boston, MA 02114

Continued from page 4

Form Approved OMB No. 158-S80004

V. FACILITY DRAWING *(see page 4)*



THIS DRAWING IS NOT TO SCALE

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1): W M A D 0 0 1 4 0 3 1 0 4 | 1

FOR OFFICIAL USE ONLY: W DUP | 2 | DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)				D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	P105	250	P	S01				
2	U028	5000	P	S01				
3	U154	1000	P	S01				
4	D008	9	T	S01				
5	D001	15	T	S01				
6	D001	13	T	S02	S01			
7	U028							Included with above
8	D002	45	T	S02	T01			
9	M001	6700	P	S01				
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Please print or type in the unshaded areas only (fill-in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-S80004

FORM 3 RCRA

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

HAZARDOUS WASTE PERMIT APPLICATION

Consolidated Permits Program

(This information is required under Section 3005 of RCRA.)

I. EPA I.D. NUMBER

F M A D 0 0 1 4 0 3 1 0 4

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below (mark one box only) to indicate whether this is the first application you are submitting for your facility or revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION (place an "X" below and provide the appropriate date)

☐ 1. EXISTING FACILITY (See instructions for definition of "existing" facility. Complete item below.)

☐ 2. NEW FACILITY (Complete item below.)

C 8 | YR. | MO. | DAY | FOR EXISTING FACILITIES, PROVIDE THE DATE (yr., mo., & day) OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED (use the boxes to the left)

| YR. | MO. | DAY | FOR NEW FACILITIES, PROVIDE THE DATE (yr., mo., & day) OPERATION BEGAN OR IS EXPECTED TO BEGIN

B. REVISED APPLICATION (place an "X" below and complete Item I above)

☒ 1. FACILITY HAS INTERIM STATUS

☐ 2. FACILITY HAS A RCRA PERMIT

III. PROCESSES – CODES AND DESIGN CAPACITIES

A. **PROCESS CODE** – Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process (including its design capacity) in the space provided on the form (Item III-C).

B. **PROCESS DESIGN CAPACITY** – For each code entered in column A enter the capacity of the process.
1. AMOUNT – Enter the amount.
2. UNIT OF MEASURE – For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER (barrel, drum, etc.)	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET (the volume that would cover one acre to a depth of one foot) OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER (Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G	LITERS PER DAY	V	ACRE-FEET	A
LITERS	L	TONS PER HOUR	D	HECTARE-METER	F
CUBIC YARDS	Y	METRIC TONS PER HOUR	W	ACRES	B
CUBIC METERS	C	GALLONS PER HOUR	E	HECTARES	Q
GALLONS PER DAY	U	LITERS PER HOUR	H		

EXAMPLE FOR COMPLETING ITEM III (shown in line numbers X-1 and X-2 below): A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

C DUP 1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S 0 2	600	G		5				
X-2	T 0 3	20	E		6				
1	S 0 1	17,290	G		7				
2	S 0 2	10,310	G		8				
3					9				
4					10				

EPA Form 3510-3 (6-80)

CONTINUE ON REVERSE